

**TECHNIQUE OF
GASTRIC OPERATIONS**

OXFORD UNIVERSITY PRESS

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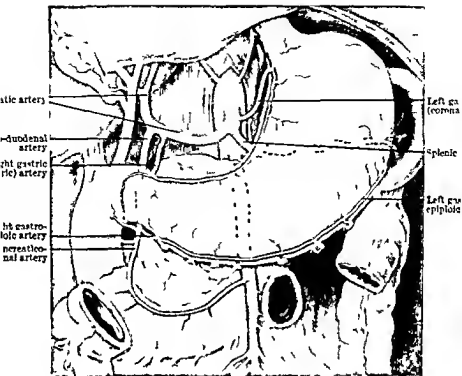
London Edinburgh Glasgow New York

Toronto Melbourne Capetown Bombay

Calcutta Madras

HUMPHREY MILFORD

PUBLISHER TO THE UNIVERSITY



The Arteries of the Stomach

OXFORD MEDICAL PUBLICATIONS

TECHNIQUE OF GASTRIC OPERATIONS

BY

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OXFORD UNIVERSITY PRESS
LONDON : HUMPHREY MILFORD

1941

PRINTED IN GREAT BRITAIN

THIS WORK IS DEDICATED
AS A TOKEN OF ESTEEM AND FRIENDSHIP
TO THE FOLLOWING STUDENTS OF THE
LONDON HOSPITAL
WHO ON ACCOUNT OF THE WAR,
WERE TRANSFERRED TO THE
SOUTHEND GENERAL HOSPITAL
FOR A PART OF THEIR CLINICAL TRAINING
SEPTEMBER 1939 TO DECEMBER 1940

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PREFACE

THIS book is intended to deal primarily with the technique of gastric operations, but I have also included a brief account of the preparation of the patient for operation, some details of post-operative management, a summary of the factors which govern the choice of operation in particular circumstances, and a few statistical figures and references.

The operations described are those in general use to-day in our hospitals, and all—or almost all—of them are those practised by me personally.

The illustrations with one or two exceptions are original and have been drawn for me mainly by Miss Pauline Larivière, a few being by Mr. Douglas Kidd, to both of whom I desire to express my most grateful and appreciative thanks for their careful, lucid, and successful work.

My warmest thanks are also due to the editor of the *Medical Press and Circular* for granting me permission to include in this book a recent article written by me on the Management of Gastro-Jejunal Ulcer for his journal; to my friend, Mr. Andrew Monro, M.D., F.R.C.S., for many helpful suggestions given; to Medical Publications Ltd. for allowing me to reproduce certain skiagrams which appeared in *Post-Graduate Surgery*, of which I was the editor; to Messrs. Down Bros. and Messrs. Arnold and Sons for kindly providing me with blocks of surgical instruments; and to the publishers for their assistance and co-operation and also for having overcome all obstacles at a time when literary production is attended by so many difficulties.

To my Secretary, Miss A M Cossham, I owe most grateful recognition for her encouragement, unfaltering skill, and unstinted devotion shown during the preparation of the manuscript and during the process of proof-reading

RODNEY MAINGOT

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April 1941

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CHAPTER I

EPIGASTRIC INCISIONS

MANY incisions have been and are still employed for exposing the stomach in the performance of gastric operations, but by far the most popular are the vertical epigastric incisions, which comprise the midline, the paramedian, and the transrectal or muscle splitting incisions. Transverse incisions are sometimes used and these afford excellent exposure, leaving a good sound scar on healing. They are of two main types: in the first, all the layers of the abdominal wall are divided transversely, in the second, the skin incision is placed transversely in one of the epigastric creases and stretches from one costal margin to the other, but the rectus muscles, after having been freed from their anterior sheaths and *lineae transversae*, are retracted widely outwards to permit of a transverse incision being made in the posterior aponeurotic sheath and the peritoneum. This latter is sometimes termed Sanders's incision and is a modification of Pfannensteil's sub umbilical incision.

Incisions placed at the outer border of the rectus muscle, which of necessity divide some of the intercostal nerves, and the *lengthy* transrectal incisions which are so frequently followed by weakness of the *medial segment of the divided muscle*, are *now seldom* if ever employed for gastric operations. *Limited* transrectal incisions are, however, sometimes used in the operation of gastrostomy, in Rammstedt's pyloromyotomy, and for suture of an acute perforated peptic ulcer.

The principles which govern all abdominal incisions may be summarized as follows

- 1 The incision must afford direct access to the organ to be investigated
- 2 The incision must be made in such a way as to inflict the minimal amount of damage on the various layers of the abdominal wall
- 3 The incision should be capable of prolongation either in an upward or a downward direction should this prove necessary
- 4 The incision should be capable of satisfactory closure, leaving the abdominal wall as strong after the operation as it was before it

For most gastric operations the midline or paramedian incision is the one usually chosen. These incisions inflict the least damage upon the layers of the abdominal wall, the access afforded is direct, they are capable of extension, and, provided they are carefully sutured in the manner about to be described, such complications as dehiscence of the wound or post operative ventral hernia should be of very rare occurrence

Some Points in the Technique of Making and Closing Epigastric Incisions

Before the abdominal towels are applied, the whole abdomen, the lower portion of the chest, and the flanks are freely painted with ether, alcohol, and then 2½ per cent tincture of iodine. Only the small area through which the incision is about to be made should be left exposed after the towels have been affixed to the skin, and the surgeon should be careful to prevent his gloved hand from coming into contact with the prepared area

The incision is made with a bold sweep of the knife. The deep dissection through the remaining layers of the abdominal wall should be conducted with a fresh scalpel, since the first one must be reckoned contaminated following its contact with the deeper layers of the skin. All bleeding points in the subcutaneous tissues, rectus sheath, or muscle should be immediately clipped with the points of fine haemostats and ligatured with No. 00 plain catgut or the finest silk, the ends of which are cut very short. Haemostasis must be complete before the peritoneal cavity is opened. Unless these small blood-vessels are ligatured off a persistent oozing may occur during the operation and cause considerable loss of blood in addition to producing contamination of the peritoneal cavity.

Tetra-cloths should be affixed to the skin margins with Scott Ridout forceps before picking up the peritoneum and incising it. It is good practice, too, to clip Lahey cellophane squares or other waterproof sheets to the cut edges of the peritoneum itself so as to isolate the wound completely and efficiently protect it from coming into contact with peritoneal exudate or with gastric or intestinal contents.

In the average case the wound is closed in layers. The margins of the peritoneum and posterior sheath of the rectus are approximated with a continuous suture of No. 0 20-day chromic catgut which is reinforced with a few interrupted sutures of the same material, the edges of the firm aponeurotic anterior rectal sheath being drawn together with a series of closely applied interrupted figure-of-eight or vertical mattress sutures of No. 0 20-day chromic catgut. The fatty layers of the wound are closed with

interrupted plain catgut stitches to obliterate dead spaces, whilst the skin margins are sutured with a series of interrupted vertical mattress sutures of fine silk, horse-hair, or deknatel. The combination of a few interrupted fine silk sutures with Michel clips often produces a very neat scar.

At the completion of the operation the wound is again painted with tincture of iodine or alcohol, and a small gauze dressing is applied, which is kept in position with two or three strips of flexible adhesive plaster placed transversely across the epigastrium. Michel clips are not left *in situ* for more than two or three days, whilst the interrupted skin sutures are removed on the 5th or 6th post-operative day.

Certain points concerning the closure of epigastric incisions are to be emphasized:

1. If through-and-through tension sutures are employed, they should be inserted through *all* the layers of the abdominal wall.

2. No advantage will be gained from using unduly thick strands of catgut in the closure of these wounds, in fact they tend to give rise to a tissue reaction with considerable outpouring of serum and are very prone to produce stitch abscesses.

3. It is a wise precaution to reinforce the continuous suture which unites the cut margins of the peritoneum and of the posterior aponeurotic sheath with a few interrupted sutures, as these diminish the lateral puff which may be very strong.

4. The wound must be perfectly dry before the suturing is commenced. The minutest bleeding point should be clipped and ligatured. Post-operative oozing often gives rise to a troublesome hematoma and favours suppuration of the wound.

5. The skin sutures should be introduced with mathematical precision and be tied lightly with just sufficient force to bring the margins evenly together.

6. All dead spaces must be obliterated, and the best way to achieve this is to draw the margins of the subcutaneous tissues snugly together with a series of interrupted figure-of-eight sutures of fine plain cat-gut.

7. Voluminous dressings and binders produce much sweating and predispose to a low-grade infection of the wound, and it is for this reason that a simple dressing such as has been described is usually employed.

8. In all cases of cancer of the stomach, where the patient is very debilitated through loss of blood, starvation, &c., in fact in all those cases where it is thought that there may be poor healing of the wound in the immediate post-operative phase, it is better to close the wound with a series of through-and-through sutures of strong silk or wire than to rely upon the more orthodox methods of closure. It is by taking this precaution that the incidence of post-operative evisceration has been reduced to a minimum.

Description of the Individual Incisions

1. Vertical Incisions.

(a) *Midline.* This incision starts at the tip of the xiphisternum and proceeds vertically downwards to the upper border of the umbilicus. It divides the skin, the subcutaneous tissues, the linea alba, the extra-peritoneal fat, and the peritoneum in the same line. It is a comparatively bloodless incision until the fatty extra-peritoneal tissues are reached. This space is crowded with numerous blood-vessels which lie deeply

hidden in the extra-peritoneal fat, and unless they are sought for and individually clipped, divided, and ligatured, a persistent and troublesome oozing will take place throughout the course of the operation.

The midline incision is easily made and easily closed, and if sutured with due care yields a very strong scar and shows little tendency to subsequent stretching. It may be closed with a series of through-and-through tension sutures of stout silkworm gut, strong silk, or copper wire or stainless steel alloy wire. Pauchet's *aiguille sabre* is a very handy instrument for the introduction of these sutures. It is passed from side to side about 1 inch away from the margins of the incision through all the layers of the abdominal wall, and after the point has been threaded with a length of wire this is drawn through, after which both ends of the wire are clipped with haemostats. In the average case some five or six lengths of wire, each about 8 inches long, should be thus introduced, and when they have all been inserted they are lifted upwards and individually twisted together to the required strength to ensure an even approximation of all the layers of the abdominal wall including the peritoneal margins, which are elevated with a finger in the abdomen while the wires are being twisted. It must be emphasized that the twisting should not be so excessive that the tissues become strangulated. All that is required is an even approximation of the two margins of the wound. The wires are cut short with a clipper, and their pointed ends are twisted to prevent them from scratching the skin or the surgeon's gloves. If subsequently these wires appear to be too tight, if they are seen to be cutting unduly into the skin, or if there is any evidence of surrounding

venous congestion, they should be partially untwisted to the required tension. The metal sutures are left *in situ* in the average case for 12-18 days.

The wires often cause a cross-hatching of the wound and may be associated with a slight degree of sepsis about the puncture spots; but apart from this, wounds thus sutured often heal surprisingly well with quite a fair cosmetic result (fig. 1).

Lately I have been closing the midline epigastric incision in clean gastric cases by approximating the cut margins of the peritoneum and linea alba with a continuous suture of floss silk, the suture being introduced in such a way that the knots lie intra-peritoneally. This is a very rapid and efficient method and results in a very firm unyielding scar. Post-operative evisceration does not occur when this method of suturing is employed, and so far the formation of stitch sinuses has been rare.

(b) *Paramedian Incision.* This incision may be placed to the right or the left of the middle line. It commences at the costal margin about 1-1½ inches lateral to the xiphisternum and is extended downwards to a point 1 inch below the umbilicus. The anterior sheath of the rectus is exposed and divided in line with the incision, and, after freeing the lineae transversae from the muscle medially, the fleshy belly of the rectus is retracted outwards to display the posterior sheath of the muscle, which is then picked up and incised together with the parietal peritoneum for the full length of the wound (fig. 2).

Pains should be taken not to buttonhole the anterior rectus sheath or the rectus muscle itself at the transverse intersections, nor to fray or otherwise damage the medial border of the muscle.

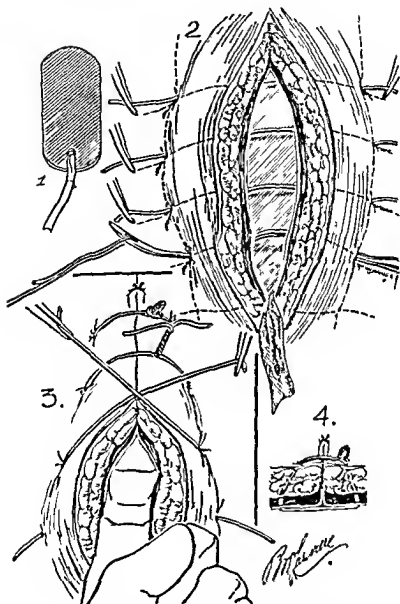


FIG 1 Method of closing a vertical jejuno-gastric incision with a series of wire sutures

1 McNeill Love a rubber guard 2 The last wire suture is about to be inserted on a lancet needle 3 The method of twisting the wires 4 Cross section of the wound showing a wire suture in position

This is an excellent incision, as it can be extended downwards without any fear of injuring any important nerves and, when carefully sutured, is not followed by any weakness of the abdominal wall. The one objection to this trap door method is that it does take time to perform, which in urgent cases may be an important consideration.

This incision is best closed with a continuous suture of No. 0 20 day chromic catgut for the posterior rectus sheath and peritoneum, together with a few interrupted sutures. After tacking down the medial border of the muscle at the intersections, the cut margins of the anterior sheath are drawn together with a series of interrupted sutures of No. 0 20 day catgut. All dead spaces are obliterated with plain catgut, and the skin margins are united with a series of closely applied vertical mattress sutures of fine deknatol. It is rarely necessary to employ tension sutures for this incision, if, however, they are used they should embrace all the layers of the abdominal wall and not, as is so frequently done, be inserted solely through the anterior aponeurotic layer.

(c) *Transrectal or Transrectus Muscle Splitting Incision* This is often indicated for the operation of gastrostomy, for Rammstedt's operation, and for the suture of a perforated duodenal ulcer. The incision should be small, and is placed directly over the middle of the fleshy belly of the rectus muscle in the epigastrium. It traverses the skin, the subcutaneous tissues, and the anterior sheath of the rectus muscle, it splits the rectus muscle itself, and then divides the posterior sheath and peritoneum in line with the original incision. It is, therefore, very rapidly made and lends itself to speedy suture.

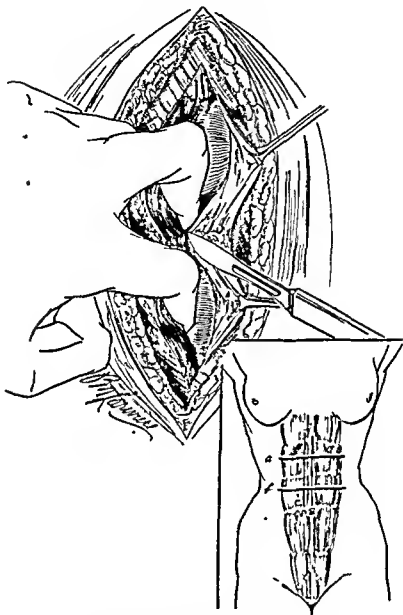


FIG. 2 The Paramedian Incision.

Inset shows (a) and (b) the positions for transverse or gastric incisions; (c) paramedian incision. (d) midline incision.

2 Transverse Incisions

(a) Perhaps the most popular incision is that of Maylard, in which a transverse skin incision is made above the umbilicus, usually between the middle and lower transverse intersections, i.e. with its mid point about 2 inches above the umbilicus. It stretches from one costal margin to the other, preferably in a skin crease, and all the layers of the abdominal wall are divided transversely for the full length of the skin incision. In order to prevent subsequent retraction, the rectus muscles may be anchored with a few interrupted sutures to the anterior aponeurosis before they are cut across (fig. 3).

With good retraction the exposure afforded by this incision is satisfactory and closure is a simple matter, as the cut margins fall together when the patient's head and chest are elevated. The cut margins of the posterior rectus sheath and peritoneum are united with a continuous suture of No. 0 20 day chromic catgut, the edges of the anterior rectus sheath are drawn together with interrupted catgut stitches, and one or two cross stitches of silk are inserted at the central portion of the wound to afford added support at what must be its weakest point.

(b) *Sanders's Incision* As I have stated, this is a modification of the Pfannensteil sub umbilical supra pubic incision. This transverse epigastric incision stretches from one costal margin to the other, its central point being in the average case some $2\frac{1}{2}$ –3 inches above the umbilicus. When the anterior sheaths of the rectus muscles are exposed, they are divided transversely and separated in an upward and downward direction from the underlying muscular bellies of the rectus muscles. The most tedious and

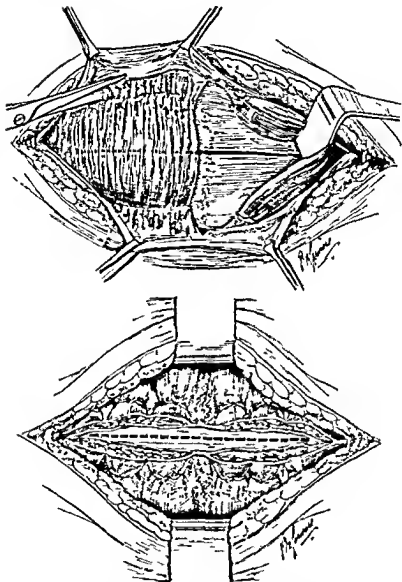


FIG 3 Transverse Pygastric Incisions.

Top fig shows Sanders's incision; bottom fig Mayland's incision

difficult part of the dissection consists in freeing the lineae transversae from the rectus muscles without fraying or buttonholing them (fig. 3).

The rectus muscles are firmly retracted laterally and the posterior sheaths of the rectus muscles and the parietal peritoneum incised transversely for the whole length of the incision.

At the completion of the operation, after the cut margins of the posterior rectus sheaths and peritoneum have been joined, the two rectus muscles fall together and meet at the middle line, after which the edges of the anterior aponeurotic leaves are sutured in the usual manner.

This incision gives by far the best cosmetic result, post-operative ventral hernia being, of course, a most unlikely event since no nerves are injured, no muscles cut, and the suture line in the peritoneum is further protected by the flat, fleshy bundles of the rectus muscles, which are very strong in this region.

CHAPTER II

THE FREDET-RAMMSTEDT OPERATION OF PYLOROMYOTOMY FOR INFANTILE PYLORIC STENOSIS

IN an infant presenting symptoms of pyloric stenosis, if on examination the characteristic pyloric tumour can be felt, provided there are no definite contra-indications to operation, it is my practice to advise pyloromyotomy after a short intensive course of pre-operative treatment.

Pre-Operative Treatment

The pre-operative treatment consists in passing a Ryle tube into the stomach, aspirating the gastric contents, and then freely irrigating the stomach with warm normal saline solution. This may be done on one or more occasions according to the amount of gastric retention present. Subcutaneous salines are given, small frequent liquid feeds are prescribed, body heat is maintained, and eumydrin is administered to relieve any concomitant pylorospasm.

It is advisable to nurse these infants in a separate room or in a special cubicle. About one hour before the operation is due to commence a mixture consisting of nepenthe $2\frac{1}{2}$ mm. and chloral hydrate 2 grs. is given by mouth to ensure that the infant is asleep when taken to the operating room. The arms and legs are wrapped in cotton-wool and lightly bandaged, and the patient is placed on a padded wooden cross and strapped into position, a small air-cushion being inserted under the lower ribs to throw out the epigastric region. The lower chest and the abdomen and

flanks are then painted with warm alcohol, metaphen, or whatever antiseptic solution the surgeon is in the habit of using. It is important to see that in the preparation of the skin all the solutions used are adequately warmed, as cold solutions, and particularly ether, may waken the child and cause crying or struggling.

The Operation

The Fredet-Rammstedt operation is best performed under a local anaesthetic, using 0.5 per cent. novocain solution. Five weals are raised in the epidermis with a fine hypodermic needle, two at the outer border of the rectus muscles and on a level with the umbilicus, two just below the tips of the ninth costal cartilages, and one over the xiphisternum. Through these weals an efficient field block can be conducted with a fine $2\frac{1}{2}$ -inch needle attached to a 20 c.c. Record syringe. In all some 50–70 c.c. of the anaesthetic solution is employed, and the skin on the outer border of the rectus muscles in the epigastrium is freely infiltrated, the nerves at the outer border of these muscles also being blocked. The subcostal infiltration is then carried out, and when this is completed the rectus muscles are widely infiltrated with the novocaine solution. It is advisable to wait some 5–10 minutes after the field block has been completed to ensure satisfactory anaesthesia and relaxation of the muscles of the upper abdomen.

A small vertical high transrectal (muscle-splitting) incision, $1\frac{1}{2}$ –2 inches long, commencing about $\frac{1}{2}$ inch below the right costal margin is placed over the centre of the right rectus muscle. The incision is carried through to the anterior sheath of the

rectus muscle, which is divided, and the muscular fibres are split longitudinally and retracted, bleeding points being clipped and tied with No 000 plain catgut.

Before the peritoneal cavity is opened, the muscles on each side of the incision are again injected with the anaesthetic solution, together with the peritoneum that is displayed. The peritoneum is picked up and incised for the full length of the incision, and a small swab soaked in the anaesthetic solution is passed between the liver and the pyloric region of the stomach and allowed to remain *in situ* for a few minutes before proceeding with the operation. The edge of the liver is then hooked upwards with a finger, and the stomach is picked up with non-toothed dissecting forceps so that it may be withdrawn through the wound. The stomach is seized with a swab, and the bulbous pylorus is coaxed through the incision and steadied with the thumb and index finger of the left hand. These fingers meet behind the pyloric tumour posteriorly, steady it, and effectively keep the stomach from slipping back into the abdominal cavity during the further steps of the operation. Abdominal squares soaked in warm saline, which are arranged around the wound and around the surgeon's hand, prevent any herniation of omentum or intestine.

The disposal of the blood vessels at the pyloric end of the stomach should be carefully noted. The veins of Mayo which mark the boundary between the stomach and duodenum are likewise observed, as the incision over the pyloric tumour should avoid cutting across the main pathway of the transversely disposed pyloric vascular radicles. On a comparatively bloodless line the incision is made through the serosa in the

longitudinal axis of the swelling, commencing precisely at the gastro duodenal junction on the gastric side of the veins of Mayo and usually at the junction of the middle and upper third of the exposed pyloric tumour, and ending at the antrum at a point where the stomach is healthy. This incision, as I have said, extends in the first instance only through the serosa and is made with a fine blade. It is then slightly deepened into the fibrotic hypertrophied pyloric muscle, and the fibres are quickly separated with the handle of the knife working up and down through the whole length of the incision, which is then further deepened until the pale, tough, pouting mucous membrane of the pyloric canal is reached. The wound thus made is widely separated and stretched transversely with the points of artery forceps, and when this is done, if any constricting muscular fibres are noticed near the dangerous gastro duodenal junction, these are cautiously divided with the point of a scalpel. It is a very easy matter to puncture the mucous membrane at the dangerous 'fornix', and if by chance a puncture is inadvertently made, bubbles of gas or bile stained fluid will issue from the small hole, thus indicating its whereabouts. These small perforations can be satisfactorily closed with one or two interrupted sutures of fine chromic catgut introduced on an atraumatic needle, the area being subsequently reinforced with an omental graft (fig. 4).

It is good practice at the completion of this simple operation to compress the stomach and thus force any air which may be in the viscus on into the duodenum. This manoeuvre will test the patency of the pyloric canal and also demonstrate minute punctures in the mucous membrane which might otherwise possibly

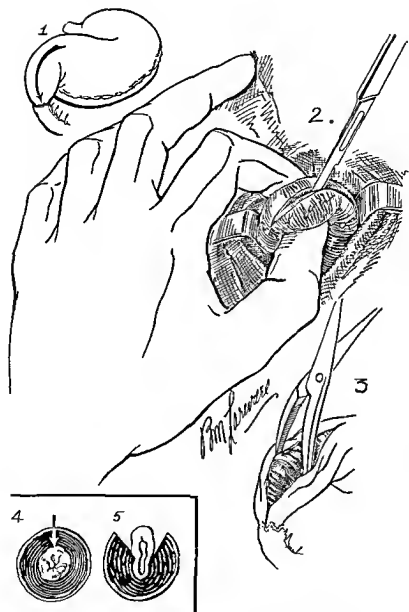


FIG 4 The Fredet Rammstedt Operation of Pyloromyotomy

pass undetected. If there are any brisk bleeding points in the cut margins of the pyloric tumour, these can be readily underrun and ligatured off.

The operation is completed by replacing the stomach into the abdomen and by suturing the wound in layers with No 0 20 day chromic catgut. The skin margins are approximated with Michel clips, and a small gauze dressing is applied to the wound and strapped into position with elastoplast.

Results of the Fredet-Rammstedt Operation

The results of this operation are exceedingly gratifying, as the patient can be put on to normal diet after the first few post-operative days, and convalescence is generally speedy and uneventful. The mortality in recent years has been greatly reduced and is now in the region of 2-5 per cent. In the author's series of 55 cases there were 2 deaths. Most of the deaths occur in late and neglected cases, i.e. cases which come to operation when emaciation is marked, when dehydration is present, and when alkalosis is pronounced. Such post operative complications as enteritis are now rarely seen owing to improved methods of post operative treatment, isolation of the patient, and efficient nursing.

CHAPTER III

THE TREATMENT OF ACUTE PERFORATED PEPTIC ULCER

IN acute perforation a sudden rupture of the whole or a portion of the base of the ulcer takes place, with the result that the contents of the stomach or duodenum are free to pour into the peritoneal cavity or into the lesser sac

The success of the treatment depends upon early diagnosis and thus upon early operation. If the catastrophe is recognized within the first 6 hours of its occurrence, the immediate results are good, as the operative death rate is then less than 5 per cent. With the passage of each hour the mortality rises sharply.

The treatment of perforated gastro-jejunal ulcer is discussed in Chapter XVIII.

Choice of Operation

The following operations are performed for perforated peptic ulcer

- 1 Simple suture
- 2 Suture of the perforation followed by gastro-jejunostomy.
- 3 Excision of the ulcer followed by suture in the *transverse axis of the gut*—pyloroplasty or gastroplasty.
- 4 Temporary gastrostomy or duodenostomy.
- 5 Partial gastro duodenal resection.

In the majority of cases the operation of simple suture is the best procedure to adopt as it is quick and easy to perform, is associated with little or no

shock, and wards off the immediate danger with the least possible operative trauma. The operation aims at saving the patient's life by a procedure which is simple and does not necessitate any specialized experience or skill in abdominal surgery. It is associated with the lowest death rate, the immediate results are good, and the late results show that some 30 per cent of the patients thus treated are rendered symptom free. The remaining 70 per cent, however, continue to have symptoms, many experiencing complications which demand subsequent radical measures such as gastro duodenal resection.

In a small proportion of cases any one of the other operations mentioned may be indicated, for instance, gastro jejunostomy may be the procedure of choice in patients over the age of 60 who give a long history of gastric trouble associated with occasional bouts of vomiting, and in whom at operation the general and local conditions are found to be in every respect satisfactory for the performance of a short circuiting operation. There may, for instance, be a marked degree of duodenal stenosis with scarring, the ulcer may be situated at the pylorus and be extensive and inextricably welded to the surrounding tissues, and may furthermore be associated with considerable gastric dilatation. Suture of such a perforation may produce what appears to be a complete blockage of the gastric outlet, and gastro jejunostomy will then become obligatory. It is unlikely, too, that if simple suture alone were performed in such circumstances it would produce a permanently satisfactory result, since the stenosis would be augmented and a short-circuiting operation would be necessary shortly after the convalescent stage had been reached.

But, in actual practice, even in such cases I rarely perform gastro-jejunostomy following suture of the ulcer, since however thoroughly the suturing of the perforation is performed, it is seldom followed by such complete post-operative stenosis that it cannot be relieved by means of an indwelling stomach tube to which suction-siphonage is applied for the first week or so following the exploratory operation. Should the obstruction persist and fractional test meals demonstrate that the acid values are sub-normal, then gastro-jejunostomy can be carried out at a second operation when the patient is in a much better condition to withstand it.

The operation of excision of a gastric ulcer followed by suture of the defect in the transverse axis of the viscus or excision of a perforated duodenal ulcer followed by pyloroplasty after Judd's method is rarely performed to-day, as the immediate and late results are on the whole unsatisfactory. Again, there are indeed few perforated peptic ulcers which lend themselves readily to such measures. This operation is only feasible when the ulcer is relatively small, the stomach or duodenum freely mobile, and the surrounding oedema sharply limited to the area of the perforation.

I have performed gastrotomy on only one occasion for a perforated gastric ulcer. In this case the perforation was large and the area surrounding the aperture was friable to a degree, and the sutures which were introduced cut out repeatedly on tying, leaving behind a larger and more jagged rent in the stomach. All that was possible in this case was to introduce a large rubber catheter through the perforation so that it would fit the edges of the hole snugly and thus act

as a cork as well as a drain to the bloated stomach. At the completion of this gastrostomy, omentum was wrapped round the tube and stitched to the vicinity of the ulcer to prevent any leakage. The patient developed a gastric fistula, and it was necessary some six weeks following the performance of the gastrostomy to carry out a partial gastrectomy which proved most difficult owing to the numerous adhesions which bound the stomach to the under-surface of the abdominal wall.

Partial gastro duodenal resection is performed almost as a routine for perforated peptic ulcer in certain continental clinics. In this country such an extensive operation would appear to be indicated only (a) in the infrequent instance of perforation associated with severe haemorrhage, (b) for repeated perforations, always provided that the patient's condition is satisfactory on the operating table and the surgeon has great skill in abdominal surgery, and (c) on the rare occasion in which a gastric ulcer is situated at the pylorus or on the lesser curvature and in which the stomach is very mobile, spillage minimal, and the parts generally lend themselves to the ready performance of this major undertaking. I have performed gastro duodenal resection in patients who have perforated while undergoing medical treatment in hospital, in patients who have ruptured a gastric or duodenal ulcer during the performance of an X-ray examination, and in patients who have perforated and vomited large quantities of blood simultaneously, but all of these cases were seen immediately after the rupture had occurred, shock was slight, and peritoneal contamination trivial. If gastro duodenal resection were performed as a routine measure for

perforated peptic ulcer, the death-rate for the complication would be excessively high. In certain gastric clinics, however, where partial gastrectomy is performed for the *early* cases, the mortality does not exceed 10 per cent.

In summing up it may be said that the routine treatment should be simple suture of the perforation, and that during the convalescent period a decision should be made as to whether medical treatment should be persevered with or whether gastro-jejunostomy or gastro-duodenal resection should be carried out when the patient's condition is satisfactory following an intensive course of medical therapy.

Those patients who have had a simple suture performed and who on discharge from hospital are symptomless should be subjected to strict medical treatment for an indefinite period and should be re-examined periodically by means of X-rays, gastroscopy, &c., for, as has been previously stated, fully 70 per cent. of such patients have a return of symptoms or develop some complication such as pyloric stenosis or reactivation of the ulcer.

Operative Technique of Simple Suture

As soon as the diagnosis of perforated peptic ulcer has been made, the patient should be admitted without delay to hospital and be put to bed in the Fowler position. A small stomach tube is passed to aspirate the remaining gastric contents, and this is left *in situ* during the operation and for the first 2 or 3 post-operative days; heat is applied to the abdomen, saline-glucose solution and/or plasma is run into a vein in the arm or leg by the slow-drip method, omnopon $\frac{1}{3}$ gr. is injected to relieve pain

and induce sleep, and the abdomen is prepared in the usual manner. If the patient cannot pass water, a catheter should be introduced and urine withdrawn and tested.

In most cases the anaesthetic of choice is a field block combined with a creeping analgesia of the omenta with 0.5 per cent novocain to which no adrenaline is added. The local anaesthesia may be supplemented with inhalations of gas and oxygen to keep the patient unconscious during the conduct of the operation.

A small epigastric incision is made and the peritoneum is picked up and incised. The extra peritoneal tissues are freely infiltrated with the novocain solution, and after aspirating the peritoneal exudate with a suction tube the omenta are injected with the anaesthetic solution. A portion of the stomach near the greater curvature is picked up, withdrawn through the wound, and steadied by the assistant, who grasps the viscus with a swab. The margins of the abdominal incision are then widely retracted to permit of inspection of the lesser curvature of the stomach, pyloric region, and first portion of the duodenum (fig. 5).

The site of the rupture is usually not difficult to discover, as fluid wells up near by, bubbles of gas may hiss through the hole, or flakes of lymph may often shroud the area in an attempt to seal it off.

In all cases the first portion of the duodenum and pylorus must be carefully scrutinized, and if there is no pathological lesion here, the lesser curvature of the stomach must be seen and palpated inch by inch for its full extent. It is rare for an ulcer to be situated wholly on the posterior wall of the stomach. Posterior

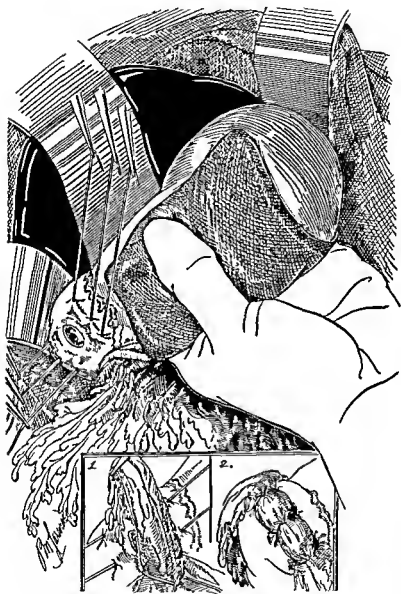


FIG 5 Suture of a Perforated Duodenal Ulcer.

Only three sutures are inserted one through the margins of the perforated ulcer, one above it and one below. The omentum is drawn over the perforation and the sutures are tied, effectively closing the aperture in the duodenum

ulcers, when they perforate, do so superiorly, i.e. near the lesser curvature. On rare occasions they may perforate inferiorly, i.e. into the omental bursa. Multiple perforations have been known to occur, but they are decidedly rare. Large ulcers may perforate at two points at their base, but the perforation of a duodenal ulcer simultaneously with that of a gastric ulcer has only been seen in very exceptional circumstances. Acute ulcers seldom perforate. Thus in Walton's series of 79 cases of perforation there was only one instance of perforated acute ulcer. It may be difficult to see a small perforation high up on the lesser curvature of the stomach, but in all instances it can be felt as the margins of the ulcer are indurated and feel like a button.

The ulcer is eventually exposed, and three sutures of No. 1/20 day chromic catgut, or preferably medium sized silk, are introduced in the following manner. The first through all the coats of the stomach or duodenum above the ulcer, the second across the perforation, picking up healthy adjacent wall on either side of the ulcer, and the third below the ulcer, also through healthy tissue, as depicted in fig. 5. The ends of these sutures are clipped with haemostats, lifted upwards and drawn apart, whilst a fair-sized portion of the free margin of the great omentum is drawn over the perforation so as to cover the site completely, the three sutures then being gently tied *seriatim* to keep the fatty pad evenly and securely in position. If the omentum cannot be drawn over the perforated zone so as to lie comfortably between the three sutures, a free omental graft should be taken, and this should be tied down with the three sutures to act as an efficient plug for the

perforated site This method of closing the perforation is simplicity itself, and as the sutures are tied gently they do not cut out nor do they produce any appreciable defect or narrowing of the lumen of the gut

This method of closing the perforation not only is applicable to gastric and duodenal ulcer perforations, but has been used with great success in closing perforated colonic diverticula, perforated jejunal ulcers, and perforations of the stomach by malignant growth

After the perforation has been closed in the manner described, the surgeon will have to decide whether the peritoneal cavity should be drained or not In no circumstances should the site of perforation itself be drained, but where the perforation has existed for more than 12 hours, and in all cases where peritoneal contamination has been excessive or where there is frank peritonitis, a small supra pubic stab wound should be made and a rubber tube introduced into the abdomen This tube is left *in situ* for 24 hours only

The small epigastric incision is closed with through and through interrupted sutures of strong silk or stainless steel alloy wire (see fig 1)

In the first 30 cases treated by the method just described at the Southend General Hospital there were only 2 deaths

Post-operative Treatment

The patient is nursed in the Fowler position as soon as he has regained consciousness The Ryle stomach tube which was previously passed through the nose or mouth into the stomach is used for

continuous or intermittent suction siphonage, and the intravenous introduction of saline glucose solution and/or plasma is continued for the next 24 hours or so. Small quantities of water and sweetened fruit juices are allowed by mouth, but apart from this no fluid nourishment is given for the first 48 hours following operation, reliance being placed on intravenous infusions.

Pain is relieved with injections of morphia which are repeated two or three times a day for the first few days following primary suture. No attempt is made to get the bowels to move until the 4th post operative day, when a glycerine enema is given. After the stomach tube has been removed, liquid paraffin, $\frac{1}{2}$ oz., is given three times a day, and a glycerine enema is injected per rectum once daily (after the 4th day) until a satisfactory spontaneous evacuation has been obtained. Mild continuous heat is applied to the abdomen, and a diathermy pad placed over the liver region on the right side is an efficient method of stimulating hepatic activity. I have found inhalations of 100 per cent oxygen by the B L B oxygen inhalation apparatus most helpful during the first 24 hours after operation, and in all cases where there has been some basal congestion. It also appears to have a beneficial effect in reducing meteorism to a minimum.

About the 4th or 5th day after operation, when all appears to be progressing well, the patient is ordered Lenhartz diet, and the usual intensive medical régime of alkaline powders, olive oil, belladonna, and essential vitamins is prescribed. Should there at any time be signs of gastric retention, the Ryle tube should be immediately reinserted and suction siphonage of the stomach carried out.

On discharge from the hospital the patient is instructed as to medical management and is told to return for re-examination in three months' time; but should there be any return of symptoms before this date he should without delay report himself for further examination.

CHAPTER IV

GASTROSTOMY

IN this operation a fistulous communication is established between the stomach and the skin of the abdominal wall. The main indications for gastrostomy may be briefly stated as follows

1 *Cancer of the Oesophagus* In the late cases when dilatation of the stricture is no longer feasible, gastrostomy becomes imperative in order to supply the patient with liquid nourishment. It is often performed prior to the institution of deep X-ray or radium treatment to the obstructing lesion, and is often an indispensable preliminary measure to the heroic operation of partial oesophagectomy.

2 *Cancer of the Cardiac Portion of the Stomach* In those cases where the tumour defies resection, gastrostomy is carried out to prevent the patient from dying of starvation.

3 *Diseases of the Pharynx and Larynx*, in which swallowing becomes impossible.

4 *Strictures of the Oesophagus* as the result of corrosive poisoning, syphilitic ulceration, or peptic ulceration.

5 *As an Avenue for the Introduction of Radon or Radium* in the treatment of certain malignant growths of the upper end of the stomach and of the lower portion of the oesophagus.

There are two main types of gastrostomy

- 1 The tract is lined with serosa, e.g. by Stamm's or by Witzel's method,
- 2 The tract is lined with mucosa, e.g. by Janeway's or by Spivack's method.

Stamm's Operation

Stamm (*Med. News*, 65, 324, 1894) was the first surgeon to describe the 'inverted inkpot' method which has often been erroneously accredited to Senn. His method is perhaps the simplest of all the gastrotomies and is frequently indicated in those cases of advanced cancer of the oesophagus in which dilatation of the stricture is not possible and in which radiation therapy may be indicated to afford some palliation.

The operation is performed under a local anaesthetic or under gas and oxygen anaesthesia to reduce the high incidence of post-operative chest complications which are the main cause of death following this procedure.

The skin incision should be a small one, not more than $1\frac{1}{2}$ –2 inches in length, and is made just below the left costal margin over the middle third of the left rectus muscle. It is deepened, the rectus is split, and the peritoneum is picked up with artery forceps and divided for the full length of the small incision. The stomach will often be found to be small and contracted and tucked beneath the liver, so that the first structure to present will be either the great omentum or the transverse colon. The colon should be gently retracted downwards until the greater curvature of the stomach comes into view. The stomach is picked up, and a portion of the anterior wall of the body of the viscus, as high up as possible, is selected for the gastrotomy. At a point midway between the greater and lesser curvatures on the anterior wall of the body of the stomach, a site is marked off with two pairs of Allis forceps which seize and lift the stomach upwards.

before making a small hole with the point of a cautery through all the coats of the stomach for the insertion of a No 12 or No 14 rubber catheter or tube of similar size. The tube is introduced for 2 or 3 inches towards the duodenum and is stitched with a single catgut suture to the edge of the small perforation which has just been made. Three purse string sutures of No 0 20 day chromic catgut are now passed on an atraumatic curved intestinal needle, the first being placed about $\frac{1}{3}$ inch away from the tube, encircling it at the point where it enters the stomach. Its ends are left long and are not tied until the two other purse string sutures have been introduced, each encircling the previous one and placed about $\frac{1}{3}$ inch away from it (fig 6 [2 1, 2, and 3])

The first purse string suture is tied while the tube is being invaginated into the stomach. The second and third purse string sutures are then drawn taut and tied to ensure that a good cone of the anterior wall of the stomach projects into the lumen of the viscus and that the tube is firmly implanted in a long serous lined tunnel (fig 6 [2 b])

A little warm citrated milk is then run into the tube through a funnel to test the patency of the tube, and to supply the patient with some much needed nourishment. The rubber catheter or tube is then led through the bottom end of the abdominal incision, and a portion of the anterior wall of the stomach above and below the tube is anchored to the parietal peritoneum with two interrupted sutures to prevent the stomach from slipping back into the abdomen (fig 7). The abdominal incision is then closed with a series of interrupted catgut stitches, and the edges of the skin incision are drawn together with silk sutures. The

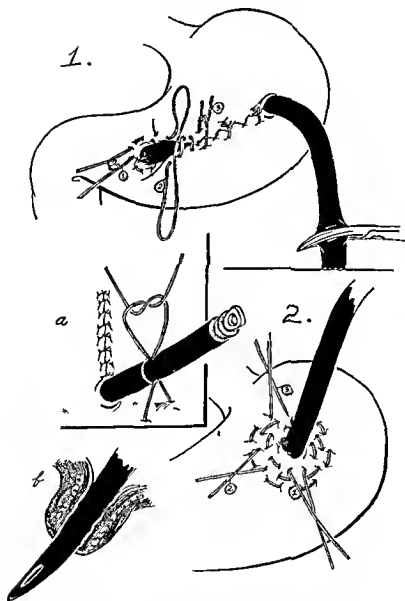


FIG 6 The Serous lined Gastrostomies

- 1 This shows Witzel's operation nearly completed
- 2 Stamm's operation

rubber tube or catheter is spigoted and anchored to the abdominal wall with strips of adhesive tape to prevent it from being dragged upon (fig. 6 [1a]).

Post-operative Care

No definite rules can be laid down as to any specific method of post-operative feeding, but it may be said that the fluid introduced into the stomach should be of a highly nutritious nature, rich in carbohydrates, creams, and vitamins, and that the feeds should be given in small amounts at frequent intervals. The tube is left *in situ* until it works loose so as to ensure a wide fistulous communication between the stomach and the skin.

As soon as the tube has worked out it should be boiled, lubricated, and inserted afresh. It is better to keep it *in situ* indefinitely because it acts as a plug and thus prevents gastric contents from spilling on to and thus corroding the skin of the abdominal wall.

Witzel's Operation

Witzel (*Zbl. f. Chir.* 8, 601, 1891) first described his method in 1891, and it would appear to be specially indicated in those cases where the stomach has contracted down to the calibre of the small intestine. Witzel's method as applied to the small intestine for drainage purposes is superior to those of Stamm and others, as when the tube is withdrawn leakage rarely if ever occurs. The incision, the exposure, and the delivery of the stomach through the abdominal incision are the same as in the preceding operation.

A No. 12 or No. 14 rubber catheter is introduced into the cavity of the stomach through a small puncture made in the anterior wall midway between the

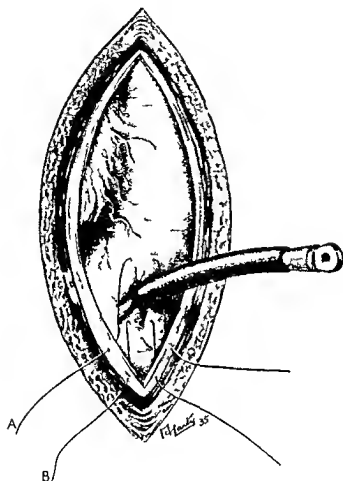


FIG 7 Stamm's Gastrostomy

The method of anchoring the stomach to the abdominal incision is depicted

greater and lesser curvature The tip of the catheter should point towards the duodenum The catheter is stitched to the margins of the puncture with a single

catgut suture, and the rubber tube is pressed longitudinally into the anterior wall of the stomach to form a groove, this groove being converted into a tunnel by means of a continuous Cushing right angled seromuscular suture (fig 6 [1 1 and 2])

This suture buries some 2-3 inches of the rubber tube as well as the site of the insertion of the catheter into the stomach and a small area of stomach wall beyond this. A few interrupted sutures of fine silk may be placed here and there to reinforce the anterior aspect of the serous lined tunnel (fig 6 [1 3])

At the completion of this operation the tube may be drawn through the lower end of the incision or through a special stab wound placed just to the right or to the left side of the abdominal incision, and after the stomach has been anchored to the abdominal wall with one or two interrupted catgut stitches, the epigastric incision is closed

There are many modifications of Witzel's operation, such as Marwedel's method and Kader's operation, but these latter are very rarely practised to day

The objection to these serous lined gastrostomies is that they tend in time to contract, and unless the tube is constantly left in position they become obliterated by scar tissue. It is therefore highly important to see that the tube is withdrawn as infrequently as possible, as it sometimes proves difficult to reintroduce it for feeding purposes

Janeway's Operation

Janeway (*J A M A* 61, 93, 1913) modified and improved upon Depage's operation (1901). Pavlov utilized Depage's method for his experiments upon the gastric secretion of dogs. Spivack (1929) described

a method, the characteristic feature of which was the formation of a valve at the base of the mucosa lined tube with the object of making the stomach watertight, but in my opinion the Janeway operation is simpler to perform and is very rarely followed by any appreciable leakage, and it is for this reason that I shall describe this method as the one of choice when a mucosa lined gastrostomy is indicated

A good account is given by Spivack in his book, *The Surgical Technic of Abdominal Operations* (p 103 1936) of the various gastrostomies and more especially of his own method which is profusely illustrated

In the Janeway operation the stomach is explored through a high left muscle splitting epigastric incision. The organ is drawn through the wound and a flap of the anterior wall, 2 inches by 1 inch, with its long axis stretching from the greater to the lesser curvature and with its base on the greater curvature is demarcated by picking up the surface of the stomach with four pairs of Allis forceps. Two pairs of these forceps mark the free upper end of the flap, and should be placed about 1 inch apart, whereas the forceps which mark the base of the flap are about 2 inches apart. An incision about 1 inch long is then made parallel to the lesser curvature, just above the two pairs of Allis forceps and extending down to the mucous coat. All bleeding points are picked up and tied before the stomach is opened with scissors at this site and a suction tube is introduced to aspirate the gastric contents. A rectangular flap of the anterior wall of the stomach is then cut through with scissors. The Allis forceps on the lesser curvature grasp the whole thickness of the free end of the flap which is

turned back, its base acting as a hinge. A No. 12 or No. 14 rubber catheter or a length of rubber tubing of similar diameter is introduced into the stomach for 2 or 3 inches and made to lie in the centre of the rectangular flap. In order to facilitate the suturing of the mucous membrane, firm downward traction is made on the end of the flap and upward traction on the upper end of the wound in the stomach (fig. 8 [1]).

Starting at the lesser curvature, the edges of the mucous membrane are drawn together with a continuous through and through suture which picks up only the mucous membrane, continues over the flap, and buries the tube (fig. 8 [2]). When this stitch reaches the extremity of the flap it is tied, one end of the suture being kept long. A second suture of No. 0 20 day chromic catgut, which may be a Lembert or a Cushing right angled suture, brings together the serous and muscular coats. When this suture reaches the end of the gastric tube it is knotted and clamped to the end of the tube with artery forceps. The gastric tube with its contained catheter is made to project through the lower portion of the incision, or is drawn through a small stab wound which is made to the left of the abdominal incision. The end of the continuous seromuscular suture is threaded through a needle which picks up the anterior sheath of the rectus muscle and stitches the gastric tube to it. Sufficient traction is then made on the mucosal stitch to facilitate this layer being sutured to the skin margins of the stab wound or to the lower portion of the abdominal wound (fig. 8 [3, 4, 5 and 6]). The abdominal wound is then closed in the usual manner.

Martin and Watson (*Surg. Gynec. and Obst.* 56, 72,

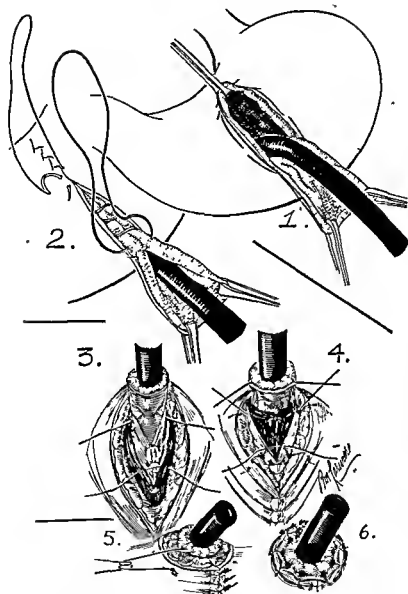


FIG 8 Mucosa-lined Gastrostomy by Janeway's method.

The more essential steps of the operation are shown

1933) give an excellent account of this operation and report 52 cases with only 3 operative deaths—5·8 per cent.

CHAPTER V

CHOLECYSTO-GASTROSTOMY AND CHOLECYSTO-JEJUNOSTOMY

UNDER the following conditions the surgeon may elect to anastomose the gall bladder to the stomach or to a loop of proximal jejunum

1 In the presence of an irremovable cancer of the head of the pancreas

2 As a first stage operation in resectable tumours of the head of the pancreas or of the peri ampullary portion of the common bile duct

3 In those cases of malignant growths of the common bile duct in which resection is not possible owing to the extent of local spread of the disease or to firm fixation of the tumour mass

4 In cases of cancer of the supra duodenal portion of the common bile duct in which following a segmental resection the performance of end to end choledocho choledochostomy or choledocho duodenostomy or choledocho jejunostomy is for one reason or another not entertained

5 Where there is chronic pancreatitis associated with jaundice

6 Where following immediately upon operative or other type of trauma of the common bile duct, the anastomosis of the healthy gall bladder to the stomach or to the jejunum is considered a safer and perhaps a more expeditious procedure than axial choledocho choledochostomy or choledocho-duodenostomy or jejunostomy

7 Where following operative or other type of trauma of the common bile duct and the establish

ment of an external biliary fistula, at the operation performed some weeks later for the re establishment of biliary intestinal continuity the gall bladder is found to be healthy. Here, after the proximal end of the common bile duct has been isolated and ligatured, the gall bladder may be anastomosed to the stomach or to the jejunum.

8 In certain cases of simple stricture of the lower reaches of the common bile duct such as may follow the extraction of a long impacted stone.

9 In certain cases of congenital abnormalities of the biliary ducts associated with jaundice.

At one time cholecysto gastrostomy was employed in the treatment of chronic gastric ulcer, but, as this procedure was found to be unsound in principle and purposeless or actually dangerous in practice, it was soon wisely abandoned in favour of partial gastrectomy or gastro jejunostomy combined with excision of the ulcer.

Most of the cholecysto gastrostomies which are carried out to day are performed for cancer of the head of the pancreas or for chronic pancreatitis accompanied by icterus. This, however, does not necessarily imply that it is the best available procedure to adopt in the conditions which I have mentioned. While cholecysto gastrostomy is probably superior to cholecysto duodenostomy, in my opinion it is definitely inferior to cholecysto jejunostomy combined with lateral entero anastomosis. In the last mentioned operation a loop of jejunum some 18-20 inches from the duodeno jejunal flexure is brought across the transverse colon and anastomosed to the fundus of the gall bladder, following which a lateral jejuno jejunostomy is carried out between the two limbs of

gut, some 3 inches or so from the ligament of Treitz, in order to deflect the intestinal current away from the biliary system, thus obviating—or at least considerably reducing—the incidence of ascending cholangitis (fig 9)

In cholecysto jejunostomy the mobile jejunum is readily applied to the gall bladder, which is more or less anchored to the liver, the attenuated wall of the gall bladder is more easily sutured to the thin wall of the jejunum than it can be to the thick muscular coats of the stomach which are constantly thrown into violent peristaltic contractions, the anastomosis can be speedily performed without the aid of clamps, spillage is minimal, and bleeding very slight. In cholecysto gastrostomy, however unless clamps are used, contamination of the operative field may occur in spite of assiduous aspiration of the gastric contents, and bleeding from the vascular antrum may be brisk and time consuming in its control. Again, in cholecysto jejunostomy the entero anastomosis between the proximal and distal loops shunts the bulk of the intestinal stream away from the gall bladder, whereas in cholecysto gastrostomy the gastric contents are forcefully flung with each peristaltic wave into the patulous mouth of the gall bladder and upwards into the main ducts and radicles of the biliary tree, which are so susceptible to infection and chemical irritation.

It has been said that in cholecysto jejunostomy the long jejunal loop may become kinked or blocked where it passes over the transverse colon, that the lateral entero anastomosis does not wholly prevent intestinal contents from reaching the gall bladder, and that an operation entailing the performance of two separate short circuiting procedures is

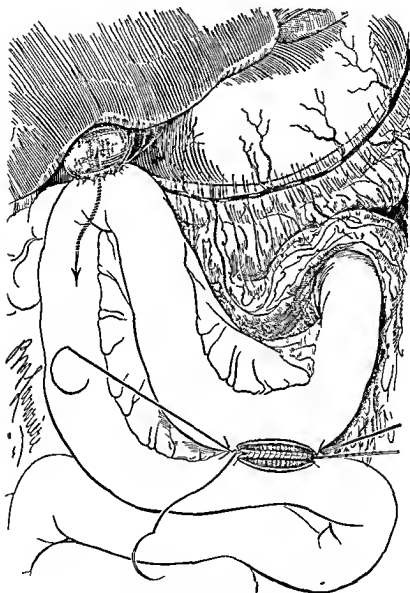


FIG 9 Cholecysto-Jejunostomy combined with
Entero Anastomosis

a lengthy affair in comparison with the expeditious union of the gall-bladder to the stomach

These criticisms may be answered by stating that

in practice ileus is rarely observed following this procedure, that the two short circuiting operations can be performed without haste in a little under 20 minutes, and that the immediate and late results are in every respect more satisfactory than those which follow cholecysto gastrostomy

Technique of Cholecysto-Gastrostomy

The pre operative treatment consists in stimulating hepatic and renal function by the intravenous infusion of glucose saline solution, increasing the coagulability of the blood by the administration of whole blood, by injections of calcium gluconate, and by the exhibition of bile salts and vitamin K, and in building up the patient's resistance by means of a non-residue diet rich in vitamins A and C and in sugars

The abdomen is explored through a right paramedian epigastric incision or through a right Kocher sub costal incision. This latter incision starts at the tip of the xiphisternum and proceeds obliquely downwards and outwards parallel to, and one finger-breadth below the costal margin. It cuts across the right rectus muscle completely, and at its outer border it severs the flat muscles of the abdominal wall for a few inches. Mackintosh squares are clipped to the skin margins and the wound is further protected with waterproof sheets and gauze swabs soaked in warm saline solution. The gall bladder is isolated, two pairs of Allis forceps seize and steady the fundus, whilst a Mayo trocar and cannula, attached to a suction apparatus by means of rubber tubing, is plunged into the gall bladder between the forceps, and the pent up bile is aspirated until the walls of the viscus collapse and fall together. Ochsner forceps

are then applied across the fundus of the gall bladder so that about $\frac{1}{2}$ inch or so of the organ projects beyond the blades. The redundant fundus is trimmed away, a vertical or oblique fold of the anterior wall of the stomach some 2 inches in length, stretching from the greater to the lesser curvature in the vestibule, is embraced by a rubber covered enterostomy clamp, the gall bladder is laid alongside this gastric fold without any tension, the field of operation is further packed off, and the anastomosis is begun (fig 10 [1])

Starting at the greater curvature of the stomach the first posterior continuous suture is introduced as a Lembert or a Cushing right angled stitch, and unites the contiguous margins of the gall bladder ($\frac{1}{3}$ inch below the Ochsner clamp) and stomach until the lesser curvature is reached, where the suture is locked once or twice and then laid aside for the time being. This suture picks up only the seromuscular coats of the stomach and of the gall bladder, and the surgeon should be very careful to prevent the point of the needle from entering the lumen of the gall bladder during the insertion of this stitch. The Ochsner forcep on the fundus is removed, the interior of the gall bladder is mopped dry, the gastric pouch is incised for a distance of 1 inch or to a length comparable with that of the cut margin of the fundus of the gall bladder, any bleeding points that are seen are picked up or underrun and tied off, and the exposed mucosal face of the stomach is carefully cleansed with moist swabs (fig 10 [2])

The second posterior through and through continuous suture which draws together the posterior cut margins of the gall bladder and stomach is now

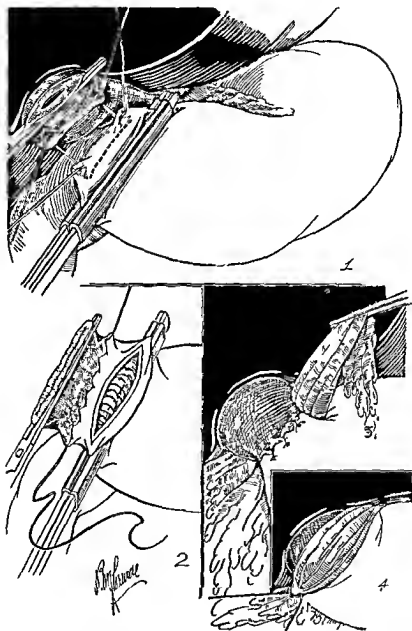


FIG 10 Cholecysto Gastrostomy

passed with great care and precision, as the gall-bladder wall is thin and the stomach wall very thick. The

individual stitches should be placed vertically and almost side by side and be drawn together with just a sufficient degree of tension to control bleeding and to approximate the margins of the two viscera evenly and firmly. The stitch again starts at the greater curvature and finishes at the lesser curvature, where it is locked, and then continued anteriorly as the first anterior through and through all coats suture, uniting the anterior cut margins of the gall bladder and stomach together in a neat line.

When the suture reaches the greater curvature it is tied to the end which was left long. The gastric clamp is now removed, and the first posterior continuous suture is picked up and introduced as the second anterior continuous suture which invaginates the first suture line for its whole length. When this suture reaches the greater curvature, it also is tied to the end which was left long.

The anastomosis is now inspected and a few interrupted sutures of fine silk should be inserted here and there, particularly at any weak spot, for the control of any bleeding points in addition to affording added protection to the suture line of catgut.

As a final stage in the operation it is a wise precaution to draw the free margin of the omentum over the suture line and to stitch it here to protect it even further, as well as to prevent the anastomosis from subsequently becoming adherent to the under surface of the abdominal wall (fig 10 [3 and 4]).

CHAPTER VI

OPERATIONS FOR BLEEDING PEPTIC ULCER

THERE are a host of conditions which cause bleeding from the stomach and duodenum, but in some 90 per cent. of the cases the causative lesion is a peptic ulcer. Thus, Rivers and Wilbur (*J.A.M.A.* 98, 629, 1932), who studied 668 consecutive cases of haematemesis at the Mayo Clinic, place the relative frequency as follows:

1. Intrinsic gastro-duodenal lesions—90·5 per cent.
2. Cirrhosis of the liver and splenic anaemia—5·1 per cent.
3. All other causes—4·4 per cent.

In Bulmer's series (*Lancet*, 2, 720, 1932) of 649 cases only 71 were due to causes other than gastric or duodenal ulcers. Stalker and Gray (*Coll. Papers Mayo Clin.* 31, 8, 1939) state that 12-20 per cent. of patients who have peptic ulcer have gross haemorrhage and that the reported death-rate in their treatment by conservative means varies from 1 to 25 per cent. Some surgeons recommend immediate operation for all bleeding peptic ulcers. Finsterer claims that operation during the first 48 hours of the bleeding is associated with a mortality of only 5 per cent. but that after 48 hours the death-rate climbs steeply to 30 per cent. Others consider that with efficient medical treatment the mortality will be less than 5 per cent. and that immediate surgical interference is only rarely justified. Gordon-Taylor (*Lancet*, 2, 811, 1935), whose valuable work at the Middlesex Hospital has

done so much to reawaken surgical interest in this subject of ulcer haemorrhage, writes as follows

‘Before any decision is taken in the matter of operating for, and in the presence of, severe haematemesis, the *greatest* caution must be exercised to ensure absolute accuracy in the diagnosis and cause of the haemorrhage, for almost the only pathological state which justifies urgent surgery is that of bleeding from a chronic peptic ulcer. There should preferably be clinical, radiological, even biochemical evidence of the existence of a chronic ulcer, or if the details of the patient’s previous history are not available, the anamnesis should leave in the observer’s mind no doubt as to the existence of a chronic ulcer of stomach or duodenum and no uncertainty as to this being the source of the cataclysmic menace to the patient’s safety.’

Scheme of Management

1 Every case of severe haematemesis or melaena, whatever the cause, should be transferred to hospital without delay

2 On admission to hospital the patient should be examined forthwith by the physician in charge, who, when he is in possession of all the relevant facts of the case, should seek the co operation of a surgical colleague

3 The pulse rate should be recorded on a chart every 15 minutes and the systolic and diastolic blood pressure every half hour

4 Complete examinations of the blood are carried out as a routine measure and should include red cell count, haemoglobin estimation, blood group, blood-

urea estimation, estimation of the blood-volume and plasma volume (Rowntree and Brown, *Coll Papers Mayo Clin* 20, 639, 1938), &c

5 Immediate arrangements should be made to transfuse the patient with citrated blood, using the slow drip method

6 Meulengracht's regime (*Lancet*, 2, 1220, 1935) is prescribed

7 The patient is nursed in a semi sitting position, no aperients are given, enemata are postponed until about the 6th day after admission to hospital, and small doses of morphia are given as required

Indications for Surgical Treatment

1 Immediate operation is indicated, and may on occasion be feasible, in cases of torrential bleeding where it is obvious that some large artery, e.g. the splenic or the left gastric, in the base of a chronic ulcer has been eroded

2 Immediate operation is indicated in the rare cases of concomitant perforation and haemorrhage

3 Early operation, preferably within 48 hours of the first attack of bleeding, is indicated in those ulcer haemorrhages in which drip blood transfusion is failing to control the blood volume and haemoglobin reading—the bleeding is continuing

4 Early operation is indicated as soon as the haemoglobin has reached 60 per cent with the drip still running in (a) in patients in whom a recent barium meal X ray examination has revealed a large penetrating peptic ulcer, (b) in patients giving a long and unequivocal history of peptic ulcer denoting that the ulcer is callous, and (c) in patients over the age of 50 who although they have been under medical

supervision have had one or more previous ulcer-haemorrhages

If in addition the patient has pyloric stenosis or hour glass stomach, indications for surgery are more cogent

In a general way it may be stated that medical measures should be persevered with in patients under the age of 40; that the younger the patient the better the prognosis; that recurrence of haemorrhage is the most dangerous prognostic sign; that the incidence and the mortality of ulcer-haemorrhage are lower in women than in men, that the best results of surgery are seen in those cases which are operated upon within 48 hours of the first bleeding, and that the surgeon's main object in operating is to arrest haemorrhage by a direct attack upon the bleeding point.

Operative Procedures

No pre-anaesthetic is, as a rule, required, and the operation is conducted under local field block supplemented by infiltration of the splanchnic zone with weak novocain solution. The abdomen is explored through a median epigastric incision and the causative lesion is displayed

If the patient has a *chronic gastric ulcer*, if he is in relatively good condition, if the parts lend themselves readily to resection, and if the surgeon has considerable experience in gastric surgery, partial gastrectomy should be performed as this is undoubtedly the best procedure. If, on the other hand, the ulcer is somewhat inaccessible or is firmly adherent to the pancreas and resection appears too complicated and difficult, or the patient's condition is unsatisfactory through excessive loss of blood, the ulcer should be

exposed through an incision in the anterior wall of the stomach and four cross mattress sutures of strong silk should be passed through the edges and base of the ulcer and firmly tied, thus controlling the bleeding

The operation is completed by closing the incision in the anterior wall of the stomach at right angles to the curvatures. Gastro jejunostomy is not carried out, as this step is superfluous

The operative treatment of *bleeding duodenal ulcer* may entail partial gastro duodenal resection or transfixion of the ulcer, which is exposed through an incision in the anterior wall of the duodenum. There is no operation which will afford the patient greater protection against a recurrence of haemorrhage than resection. When therefore the patient is operated upon within the first 48 hours of the bleeding, when he appears to be in a satisfactory condition, when the duodenum can be mobilized and the ulcer is not too large in size or too firmly fixed to the underlying head of the pancreas, partial gastro duodenal resection should be performed while the blood drip is regulated to a slow pace. This operation is feasible in 25 per cent. of the cases

When resection is considered too hazardous, the ulcer should be exposed by an ample incision through the anterior duodenal wall and pyloric sphincter, the edges of the wound in the gut are held apart with Allis forceps, and four cross mattress sutures of strong silk are inserted deeply through the edges and base of the ulcer and tied very tightly (fig 11). This controls the bleeding and obliterates the ulcer and is, in my opinion, a most efficient emergency method of dealing with the bleeding artery. The long wound in

the anterior wall of the duodenum and pylorus is then closed transversely as in Judd's pyloroplasty,

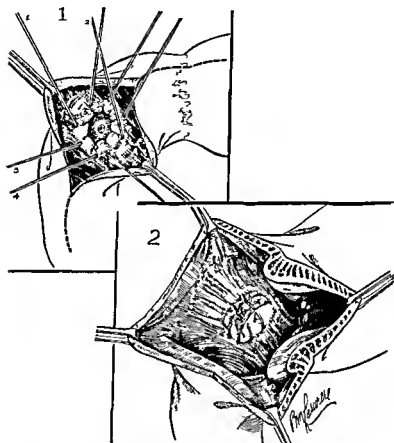


FIG 11 Method of exposing a bleeding duodenal ulcer and of controlling the haemorrhage by inserting four interrupted sutures of strong silk and tying them firmly

or the incision in the duodenum and pylorus may be extended in both directions and the operation be completed after the Finney plan

CHAPTER VII

POSTERIOR GASTRO-JEJUNOSTOMY

IN the operation of posterior gastro jejunostomy a portion of the posterior wall of the body of the stomach is anastomosed to the proximal jejunum by the side to side method

Indications

1. In Certain Cases of Chronic Duodenal Ulcer.

The treatment of chronic duodenal ulcer is medical except where complications have occurred and where in spite of repeated and prolonged courses of *efficient* medical therapy there has been a persistent recurrence of incapacitating symptoms

The treatment of such complications as ulcer haemorrhage and perforation have already been dealt with, and it is now necessary to consider the appropriate treatment for pyloric stenosis due to duodenal ulcer and those non obstructive cases which show no response to well applied medical measures

Let us deal first with the problem of pyloric stenosis due to duodenal ulcer In the main there are two types (a) chronic cicatrizing duodenal ulcer in which there is a marked degree of gastric retention and hypochlorhydria or even anacidity, and (b) pyloric obstruction due to spasm and oedema of the outlet of the stomach associated with a simple lesion in the first portion of the duodenum

The preliminary treatment of both types is identical and consists in gastric aspiration and lavage, the correction of dehydration and loss of plasma electrolytes by the intravenous injection of plasma and of

glucose-saline solution, the relief of constipation, the giving of a nutritious liquid diet containing the essential vitamins, the exhibition of anti spasmodics, &c. If after a thorough course of treatment the obstruction still remains unrelieved, and if following the frequent cleansing of the stomach over a period of some days there is no return of the acid values or the revived gastric juice is markedly deficient in hydrochloric acid, then posterior gastro jejunostomy should be advised. If, on the other hand, the spasm relents, the oedema and the gastritis disappear, and the pyloric outlet once more becomes amply patent, and if in addition the gastric juice which is poured into the stomach is adequately loaded with hydrochloric acid, it is wise to persevere with medical measures. If, however, there are repeated attacks of obstruction and the patient can make no headway under medical management, operation should be advised, but the procedure here should not be a short circuiting one but rather a radical gastro duodenal resection.

Gastro jejunostomy should not be performed for uncomplicated duodenal ulcer cases in which gastric tone is good and emptying rapid, and in which fractional test meals indicate the presence of hyperchlorhydria. The surgical treatment of the non obstructive types of duodenal ulcer is partial gastrectomy, but operation should not be countenanced unless pain is incoercible, the patient is for one reason or another unable to carry on the medical treatment prescribed, e.g. owing to the nature of his work, &c., or bleeding from the bed of the ulcer is persistent and the resulting anaemia is progressive in spite of the measures aimed at its arrest.

Thus the prime indication for gastro jejunostomy in duodenal ulcer is scar stenosis associated with dilatation of the stomach and a permanent lack in the hydrochloric acid content of the gastric juice. The operation may also be indicated in aged and infirm patients, who although unable to withstand partial

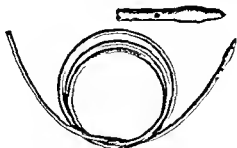


FIG 12 Ryle's stomach tube

gastro duodenal resection are nevertheless in urgent need of relief by surgical measures

2 In Certain Cases of Chronic Gastric Ulcer

The only safe rule to follow in connexion with patients suffering from chronic gastric ulcer is that the ulcer shown on skiagrams or visualized on gastroscopy is malignant unless proved otherwise by satisfactory healing under medical treatment

The majority of gastric ulcers can be induced to heal by giving the patient citrated milk through an indwelling duodenal tube (fig 12). The milk is run in at an even slow drip day and night so that about 6 pints are introduced in the 24 hours. The patient is also encouraged to drink sweetened lime or lemon juice, barley water, &c, and is given a mixture of olive oil and belladonna three or four times daily. At the end of three weeks a barium meal X ray examination and a gastroscopic investigation are carried out

to see if the ulcer has diminished in size, and the faeces are tested to ascertain whether occult blood is disappearing from the stools. The visual signs of sound and progressive healing of the ulcer demand perseverance with these methods. On an average it takes about three months for a chronic gastric ulcer to heal satisfactorily under strict medical supervision (Spriggs, *B M J* 2, 39, 1940). The disappearance of the crater on skiagrams does not necessarily mean that the ulcer has healed. It is rather a sign that the lesion is healing well, that the surrounding oedema is subsiding, that the crater is flattening out, and that a new regenerated although inferior mucous membrane is creeping across the gap in the gastric wall. No patient is regarded as cured until the symptoms have ceased, the stools have been free from occult blood for several weeks, the haemoglobin percentage is normal, and the X ray and gastroscopic evidence of sound healing is irrefutable. If, on the other hand the ulcer has *not* diminished in size by the end of 3 weeks' treatment and if occult blood is still present in the stools, it must be assumed that the ulcer is potentially or actually malignant, and operation should accordingly be advised, but here again the operation of choice is partial gastrectomy.

The operation of posterior gastro jejunostomy is rarely indicated in the treatment of gastric ulcer. It is, of course a necessary step following wedge or V excision of the ulcer, and it may be the only feasible procedure where the ulcer is irremovable, as sometimes obtains in feeble patients who have large penetrating ulcers situated high up on the lesser curvature of the stomach. Again, posterior gastro jejunostomy may be the method of choice in cases of deeply pene-

trating ulcers situated near the cardia associated with a marked degree of pylorospasm and gastric retention. Some surgeons recommend gastro-jejunostomy for ulcers situated in the pyloric region of the stomach in which gastrectomy is for one reason or another contra-indicated, but with these non-resectable ulcers of the gastric outlet pyloric occlusion combined with partial gastrectomy is undoubtedly a superior undertaking.

3. In Certain Cases of Irremovable Cancer of the Pyloric Segment of the Stomach.

Here the usual procedure is anterior or posterior gastro-jejunostomy, but where Devine's operation can be carried out it should be the method of choice (see Chapter XVII).

- 4. In Certain Cases where the First Portion of the Duodenum or the Pyloric Segment of the Stomach is partially or wholly occluded by Pressure from without, as may be occasioned by severe perigastric inflammation, compression by a tumour, &c.**
- 5. Where following a Billroth I Type of Resection and Repair or some Plastic Operation upon the Outlet of the Stomach, Symptoms of Obstruction supervene and are impossible to correct by Suction-Siphonage.**
- 6. Following Certain Traumatic Lesions of the Duodenum.**

In summing up it may be stated that the main indications for posterior gastro-jejunostomy are pyloric stenosis due to a long-standing cicatrizing duodenal ulcer associated with permanent reduction in the hydrochloric acid of the gastric juice and in aged patients with chronic duodenal ulcer accompanied by severe symptoms which show no response

to medical treatment. It may be the only procedure available for a high, large, penetrating, irremovable gastric ulcer associated with severe pylorospasm and gastric retention, and it may be selected as the simplest undertaking for the relief of obstruction caused by an inoperable cancer of the pyloric segment of the stomach.

At the present day the operation is greatly abused, especially in the treatment of chronic duodenal ulcer unassociated with obstructive symptoms. The surgeon should adopt a conservative attitude with those cases of pyloric obstruction due to duodenal ulcer in which the blockage is temporary and is occasioned by spasm and oedema of the pyloric sphincter. If gastritis is present in such cases test meal examinations frequently show achlorhydria, and the indications for posterior gastro jejunostomy may then appear to be cogent, but the gastritis and pylorospasm alike in these cases are usually of a temporary nature and the acid often returns in full force after repeated aspiration and irrigation have effectively rid the stomach of its mucus laden contents. To perform gastro jejunostomy in these circumstances is to pave the way for the possible formation of a jejunal ulcer at some later date (see Chapter XVIII).

The Technique of Posterior Gastro-Jejunostomy.

General Considerations The first gastro jejunostomy was performed by Wolfier in 1881 at the suggestion of his assistant, Nicolandoni. This was an anterior, long loop, ante peristaltic gastro jejunostomy. von Hacker (1885) was the first to perform posterior gastro jejunostomy on the recommendation of Courvoisier (1882), using a long jejunal loop for

purposes of anastomosis. It was not until 1900 that Petersen advised the no loop posterior gastro-jejunosomy, which method was improved upon by Moynihan and W J Mayo.

The opening which is made in the stomach may be vertical (Moynihan), oblique (Mayo), or transverse (Kocher). The vertical opening should extend from the lesser to the greater curvature in line with the vertical portion of the lesser curvature and right border of the oesophagus. The oblique stoma stretches from the lesser to the greater curvature, starting 1 inch to the right of the incisura and extending downwards to a point on the greater curvature 1 inch to the left of an imaginary line produced vertically downwards from the right border of the oesophagus. The transverse stoma is best made at the greater curvature itself at its most dependent portion, after detaching the vascular epiploic arch from this region. Here again, a vertical line which is produced downwards from the free margin of the lesser curvature should transect into two equal parts the stoma which is made at the greater curvature. It will be seen that a feature common to all these openings in the stomach is that one portion is situated at the greater curvature itself, in other words, at the most dependent portion of the stomach.

The loop of proximal jejunum selected for the anastomosis should be neither too long nor too short. It needs to be long (5-8 inches from the duodeno-jejunal flexure) in patients who are suffering from gastropsis, so as to allow for any downward dragging of the stomach. It should be short (3-4 inches) in those patients in whom the stomach is small and lies high up and transversely in the epigastrium.

At the completion of the anastomosis the length of the stoma should never be less than $1\frac{1}{2}$ inches and never more than $2\frac{1}{2}$ inches. It should, in fact, always be the surgeon's aim to fashion the stoma

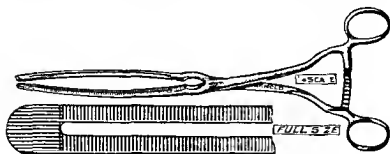


FIG 13 Sherren's Gastro-Jejunostomy Clamp

so that it can comfortably accommodate at least three fingers

The suturing should be performed with curved or straight eyeless or atraumatic needles threaded with No 00 or No 0 20 day chromic catgut. The anastomosis is made with continuous sutures of this material, but at the completion of the operation the suture line may, if deemed advisable, be reinforced with a few interrupted sutures of fine silk. Special enterostomy clamps should not be employed as a routine, but rather only in those cases where speed is essential. When used, these clamps must be applied by the surgeon himself with great care and precision to ensure that no damage is done to the friable mucous lining of the stomach or jejunum (fig 13)

Details of the Operation of Posterior Gastro-Jejunostomy

The abdomen is explored through a median epigastric or right paramedian incision, and the explora

tion of the abdominal viscera is conducted in a methodical manner. The stomach should be carefully palpated, and especially the whole length of the lesser curvature and the pyloric region. The posterior aspect of the stomach can be inspected through an opening made in the gastro-colic ligament. The pyloric sphincter should be tested with regard to its patency, and the duodenum examined for the presence of any induration or other abnormality. Any lesion which is found in the stomach or duodenum should be demonstrated to the assistant before deciding upon the nature of the operation to be performed. The pancreas is best displayed through the gastro-hepatic omentum by drawing the stomach firmly downwards. The gall-bladder should be emptied by compression, the consistency of its walls ascertained, and a search made with the fingers to detect the presence or absence of gall-stones. The hand should be swept over the surface of the liver and spleen and then slipped downwards into the pelvis to palpate the organs in this region before investigating the condition of the appendix, the colon, and the mesentery. Finally, the duodeno-jejunal junction should be sought for and inspected. To do this satisfactorily the great omentum and transverse colon should be drawn through the wound and lifted upwards, whilst the right hand is passed along the inferior surface of the mesocolon to the left of the spine. The fingers should then hook up the tethered coil of proximal jejunum and deliver it through the abdominal incision.

The duodeno-jejunal junction and the ligament of Treitz are then scrutinized to detect whether any abnormality is present. If the first loop of jejunum is

firmly anchored to the under surface of the mesocolon, or, if there are numerous congenital bands or adhesions present in this situation, it may be unwise to dissect them free in order to facilitate the performance of a posterior gastro jejunostomy. In such cases the anterior operation may be preferable. Again, the posterior operation may be contra indicated if the mesocolon is unduly laden with fat, if the middle colic artery or its arching branches are impossible to visualize or if they pursue an anomalous course, if numerous large branching blood vessels occupy the mesocolon and no suitable space remains between them through which the stomach or jejunum may be drawn, or where the mesocolon is unduly stunted or adherent to the stomach bed.

If no contra indications exist to the performance of posterior gastro jejunostomy, the operation is conducted on the following lines.

If there is a chronic cicatrizing duodenal ulcer, the first step in the operation consists in inserting a May o-Kelling stitch to occlude the pylorus even further and to bury the scarred area of the duodenum with adjacent omenta. This stitch picks up the fatty omental tissues above and below the ulcer and when tied draws these structures over it.

If the stomach is large it is better to make a vertical stoma. If, on the other hand, the stomach is small and contracted, the stoma should be placed at the greater curvature.

We will assume that the vertical stoma is chosen. A pair of Allis forceps is placed on the lesser curvature at the incisura, and another pair is placed immediately opposite this on the greater curvature, these forceps acting as markers. The next step consists in

drawing the omentum and transverse colon through the wound to display the under surface of the mesocolon, and a point to the right of the middle colic artery beneath its main arching branch is selected for making the opening in this structure so that the stomach may be drawn through the rent. At a bloodless spot the mesocolon is clipped with a haemostat and then nicked with scissors, thereby opening up the lesser sac.

The small vertical opening thus made is cautiously enlarged with scissors for a distance of some $2\frac{1}{2}$ –3 inches, care being taken not to cut any large arching branch of the middle colic artery. Secondary small vascular arches may, of course, be underrun, tied off, and divided. A fold of the posterior wall of the body of the stomach with its affixed Allis forceps is then drawn through the opening thus made. The Allis forceps on the greater curvature will now be seen at the upper end of the opening (near the colon), while the pair of Allis forceps on the lesser curvature guides and bulges a fold of the stomach through at the lower end of the opening (near the duodeno-jejunal flexure). The fold of stomach to be utilized in the anastomosis is again freely mobilized by division of the filmy adhesions and is drawn farther through the opening in the mesocolon. The Allis forceps at the selected point on the greater and lesser curvatures at the extremities of the fold of the stomach to be used in the anastomosis are elevated, while the edges of the opening in the mesocolon are stitched with a series of interrupted sutures all round the projecting fold of stomach. It is better to anchor the edges of the mesocolon to the stomach at this stage, as the suturing can be done more freely and more accurately than when

the jejunal loop is in the way, as it will be by the end of the operation (figs 14 and 15)

It should be noted especially that the mesocolon is stitched to the stomach wall itself, well beyond the area to which the jejunum will be attached, and not to the finished suture line of the gastro enteric stoma. It was formerly sutured in the latter position

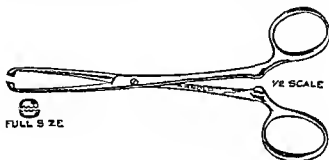


FIG 14 Allis Forceps

to act as an omental reinforcement, but this practice has been abandoned. By the former method the anastomosis is placed well into the greater peritoneal cavity, and constriction of the stomach is rendered impossible.

When the edges of the mesocolon have been sutured all around the protruding fold of the stomach which is to be utilized in the anastomosis, any large blood-vessels which are visible, particularly at the greater and lesser curvature, should be individually underrun and tied off.

If enterostomy clamps are used, the gastric fold is raised and clamped, the tips of the blades pointing to the patient's chin and the handles towards the symphysis pubis. The selected coil of jejunum is picked up and the portion chosen for the anastomosis, say 4-5 inches from the duodeno jejunal flexure, is

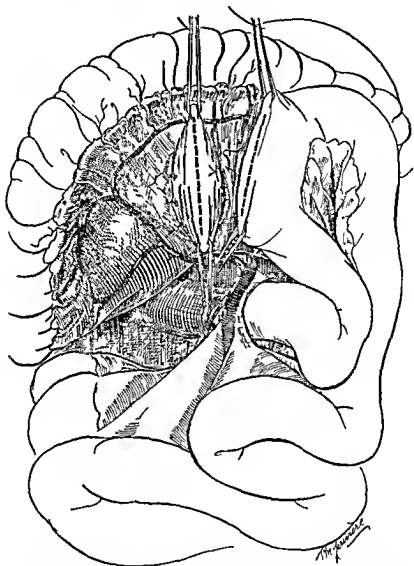


Fig 15 *Posterior Gastro-Jejunostomy with out the aid of clamps*
The portions of stomach and jejunum selected for anastomosis are about
to be laid side by side

likewise clamped, after which the two clamps are brought together, side by side, and the parts are ready to be anastomosed (fig 16)

When clamps are not employed, the anti mesen

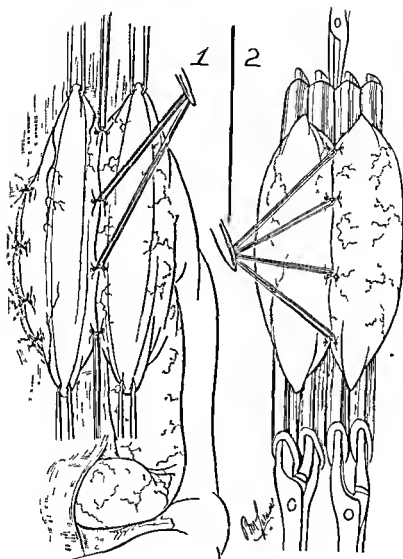


FIG 16 Posterior Gastro-Jejunostomy

1 The operation is being performed without the aid of clamps

2 The operation is being performed with clamps

Note that four fine interrupted silk sutures are inserted before the anastomosis is commenced

teric border of the portion of jejunum chosen for the anastomosis is picked up with Allis forceps which are

placed at a distance of 3-4 inches apart. The proximal point of the jejunal loop engaged in the anastomosis is applied to the lesser curvature of the stomach, while the distal point is applied to the greater curvature. The transverse colon, the omentum, and any intestines which have prolapsed through the abdominal incision are now replaced into the peritoneal cavity and are prevented from protruding into the field of operation by means of suitably placed abdominal packs. The only portions of the viscera which are allowed to remain outside the abdomen are those about to be anastomosed.

The operative field is completely isolated with hot moist towels, over which waterproof squares are placed. The folds of the stomach and jejunum are now kept taut and in close apposition and are steadied by an assistant who holds the upper and lower sets of Allis forceps in his fingers.

Four or five interrupted sutures of fine silk are introduced to approximate the adjacent walls of the stomach and jejunum, to prevent rotation of the jejunum, and to act as suitable tractors. The first posterior suture is now introduced as a Cushing right-angled stitch which unites the contiguous seromuscular coats of the stomach and the jejunum from the lesser to the greater curvature, and when this stitch reaches the greater curvature it is locked and laid aside to be used again at a later stage in the operation (fig. 17 [a]).

Two longitudinal incisions (on an average about $2\frac{1}{2}$ inches long) are now made with a knife through the seromuscular coats of the stomach and jejunum down to the mucosa parallel with and $\frac{1}{2}$ inch from the posterior suture line. The mucosa of the stomach

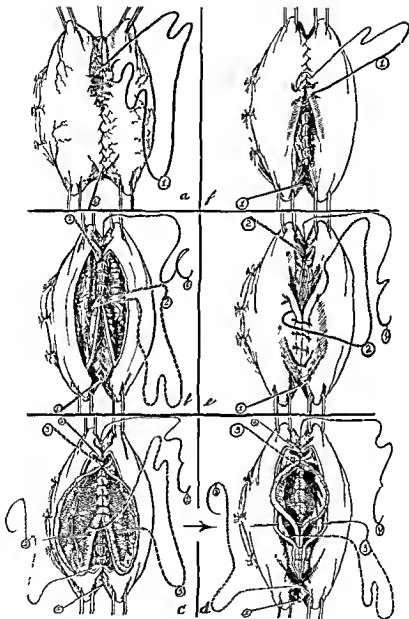


FIG. 17 Posterior Gastro-Jejunostomy.

a, b, and c show the posterior sutures being introduced
d, e, and f depict the insertion of the anterior sutures.

and jejunum will protrude through these two incisions as the seromuscular coats retract, and they can be a little further freed by dissection with a knife. The blood vessels which are seen coursing over the exposed surface of the gastric mucosa are individually underrun and tied off.

The second posterior stitch starts on the greater curvature and is introduced as a continuous through-and-through all coats suture. The stitches are placed parallel with and close to one another and are drawn evenly and firmly to ensure a perfect approximation and absolute haemostasis. When this stitch reaches the lesser curvature, it is locked and put on one side to be used at a later stage in the operation (fig 17 [b]).

An incision is made through the gastric mucosa, large enough to admit the suction tube which is used to aspirate the contents of the stomach. The mucous membrane of the stomach is picked up with forceps and divided with scissors for almost the full length of the seromuscular incision. The jejunal mucous membrane is similarly picked up and incised and the gut thoroughly sponged and cleansed. Redundant gastric and jejunal mucosa is not excised, as it is considered that such trimming away might predispose to the formation of an anastomotic ulcer.

The third continuous suture approximates the margins of the mucous membrane of the stomach and jejunum posteriorly, and when the suturing has been thus completed, the stitch turns the corner at the lesser curvature and returns along the anterior margin as the first anterior stitch, without interruption, locking, or knotting, until the end which was left long is reached, when a double knot is tied and the ends are cut short (fig 17 [c and d]).

This first anterior stitch picks up not only the cut margins of the mucosa of the stomach and jejunum but also takes bites of the muscularis to ensure that there is a firm and even approximation (fig 17 [d]). The second posterior suture is then taken up and returned as the second anterior suture, being passed as a closely applied continuous Lembert suture which invaginates the first anterior continuous suture line. When this stitch reaches the greater curvature it is knotted and cut short (fig 17 [e]).

The third posterior suture is now picked up once more and introduced anteriorly as a Cushing right angled stitch, and when it reaches the lesser curvature it is tied to the point where it started (fig 17 [f]).

The anastomosis is now completed. The suture line is swabbed and carefully inspected, and a few interrupted sutures of fine silk are introduced here and there at any point which appears to be weak or which requires reinforcement. If there is persistent oozing from any particular spot along the suture line this is underrun and controlled with a fine silk suture. The operation is completed by testing with the fingers the size of the stoma and by replacing the colon and omentum into their normal positions.

If clamps are used they should be slackened when the posterior suture line has been completed and again just before the anterior suture line is finished, in order to detect any bleeding vessel which may require attention.

Should the surgeon elect to fashion a stoma at the greater curvature, he should detach the vascular epiploic arch from the middle third of this region by individually picking up each blood vessel which passes from the main vascular arch to the greater

curvature, tying it off and dividing it, thus leaving the greater curvature bared over a wide area at its most dependent portion. When the opening in the mesocolon has been made, the selected loop of jejunum is drawn across to the bared greater curvature so that the proximal portion of the jejunum lies to the left and the distal portion to the right, i.e. towards the pylorus, in other words, the anastomosis is isoperistaltic.

At the completion of the operation the free edge of the detached omentum is sutured to the anterior wall of the stomach above the anastomosis.

In certain cases the stomach is fixed and cannot easily be drawn through the opening in the mesocolon. In such cases the lesser sac should be exposed by an opening in the gastro colic ligament immediately below the most dependent portion of the stomach, and after drawing the proximal jejunal loop through the opening in the mesocolon the anastomosis is made to the posterior aspect of the stomach as close to the greater curvature as possible.

At the completion of this operation the cut margins of the mesocolon should be affixed to the posterior aspect of the stomach all around the anastomotic junction. Even in those cases where it is impossible to traverse the mesocolon for purposes of making a posterior gastro jejunostomy, it is nevertheless feasible to perform a modified posterior operation by detaching the great omentum from the transverse colon and drawing the jejunal loop over the bared portion of the large gut and applying it to the posterior aspect of the body of the stomach close to the greater curvature in an isoperistaltic direction, so that the stoma, when completed, is in a dependent position.

and is transected by an imaginary line which is drawn downwards from the right border of the oesophagus. When the suturing is finished, the omentum is drawn downwards as a drape over the proximal and distal loops of the jejunum.

Post-Operative Treatment

During the first 3 or 4 days after operation the patient is given only frequent small sips of fluids by the mouth. After this time he is ordered Lenhartz diet and a strict ulcer treatment (see Table I). Glucose saline solution is given intravenously for the first 48 hours or so, and if gastric retention proves troublesome suction siphonage is employed.

For the first 3 months following operation the patient should be under medical supervision, smoking and alcohol are forbidden, and great pains are taken in the matter of feeding.

TABLE I
Modified Lenharz Diet

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Eggs	1	1½	2	2½	3	3½	4	4	3	3	3	2	2	2
Milk, oz	5	7½	10	12½	15	17½	20	25	25	25	25	25	25	25
Glaxo, or milk and water, oz (equal parts)	5	7½	10	12½	15	17½	20	25	25	25	25	25	25	25
Lactose, drms			6	6	8	8	12	12	14	14	14	14	14	14
Plasmon, drms					2	2	3	3	3	3	3	3	3	3
Blancmange, oz								3½	3½	7	7	10	10	10
Rusks, oz								½	½	1½	2	2½	3	4
Pounded fish, oz									2	2	2	2	2	2
Butter, oz										½	1	1½	1½	1½
Quantity given, oz each feed	1	1½	2	2½	3	3½	4	5	5	5	5	5	5	5
Caloric value (approximate)	160	240	400	475	580	685	825	1,115	1,185	1,650	1,820	2,010	2,080	2,200

Water, 1 oz., may be given in between feeds after the 3rd day
Feeds are given 2 hourly by day, 4 hourly by night, 10 feeds in the 24 hours

CHAPTER VIII

. ANTERIOR GASTRO-JEJUNOSTOMY

ALTHOUGH anterior gastro jejunostomy is in many respects an inferior procedure to posterior gastro jejunostomy, it may nevertheless be the only feasible procedure when the latter operation is impracticable, for the reasons already given

In the operation of anterior gastro jejunostomy a portion of the proximal jejunum, some 10-18 inches from the duodeno jejunal flexure, is selected for anastomosis with the most dependent part of the greater curvature of the stomach. A long loop is chosen because the distance from the duodeno jejunal flexure to the greater curvature is comparatively great. The portion of intestine selected for the anastomosis has to be drawn from its hidden retreat across the great omentum and transverse colon and then applied to the stomach without tension, and when the junction is effected, the two jejunal limbs should ride smoothly over the large bowel without any risk of compression or linking. The actual length of small bowel from the fixed duodeno jejunal flexure to its point of application to the mobile greater curvature will, of course, vary considerably in individual cases. Thus, in thin subjects in whom the stomach may be ptosed and the great omentum flimsy, the distance between these two points may not be greater than 12 inches, whereas in those cases in which the stomach is contracted and placed high up in the epigastrium, and especially where the great omentum is laden with fat and is bulky, a longer loop, say 18 inches, will be necessary.

The anastomotic opening should be at least 3 inches long and should be made at the most dependent portion of the stomach, i.e. transversely and precisely at or just anterior or posterior to the greater curvature. The opening is planned so that it is equally bisected by an imaginary line which is produced downwards from the vertical portion of the free border of the lesser curvature. An isoperistaltic anastomosis should be fashioned with the jejunal loop curving gracefully from the left to the right along the greater curvature of the stomach.

The abdominal exploration is conducted through a vertical epigastric incision, the causative lesion is displayed, and if conditions warrant the adoption of this operation it may be conducted in the following manner.

The stomach, the transverse colon, and the great omentum are drawn through the abdominal incision and the numerous small stunted blood vessels which spring from the concave superior margin of the vascular epiploic arch to the gastric wall are individually underrun, ligatured with fine silk, and then divided, thus baring the middle third or more (approximately 5-6 inches) of the greater curvature in preparation for the anastomosis which is about to be made.

The first jejunal loop is picked up, the ligament of Treitz is identified, and the portion of intestine selected for union with the stomach is taken over the transverse colon and laid alongside the denuded greater curvature from left to right so that its distal end points towards the pylorus. The whole length of the bared greater curvature is then put on the stretch and slightly rotated upwards to expose the posterior aspect of the stomach, after which Allis forceps are

applied at each extremity of the denuded area to act as markers and tractors. Allis forceps are also fixed some 5 inches apart to the anti mesenteric border of that segment of jejunum which is about to be anastomosed to the stomach. The Allis forceps at each end of the stomach and of the jejunum are elevated and drawn outwards to produce two equal folds, each about 5 inches long, which are then laid side by side without any tension or kinking.

The operative field is packed off with cellophane squares and gauze pads and the suturing is commenced.

Three rows of continuous sutures of No. 0 20 day chromic catgut are employed in making this anastomosis. The first posterior seromuscular Cushing stitch is a lengthy one and unites the contiguous margins of the jejunum ($\frac{1}{2}$ inch away from the mesenteric border of the intestine) with the posterior wall of the stomach ($\frac{1}{3}$ inch away from the bared greater curvature) for a distance of some 5 inches. The suturing starts at the pyloric end of the stomach where its end is clipped by a haemostat, and finishes near the lower border of the gastro splenic omentum where it is locked once or twice and laid aside for the moment (fig. 18).

A longitudinal incision is now made in the greater curvature. It should be about 3 inches long and should itself be equally bisected by an imaginary line drawn vertically downwards from the right border of the oesophagus. The incision is at first carried through the seromuscular layers down to the mucosa of the stomach. The blood vessels exposed on the surface of the mucous membrane are individually ligated to eliminate any bleeding both during and

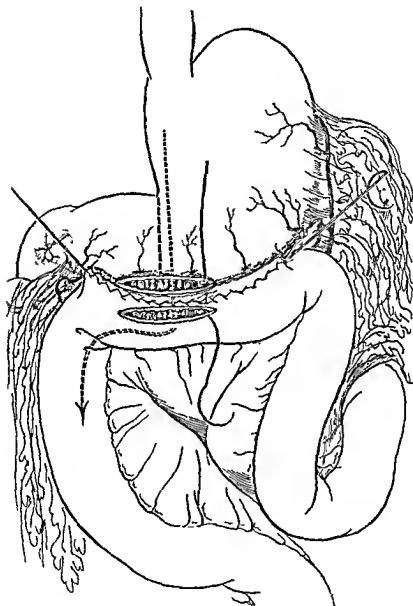


FIG. 18. Anterior Gastro Jejunostomy.

after the operation, and the portion of anchored jejunum immediately opposite the greater curvature which has been incised is likewise divided down to its mucous lining. The seromuscular incision in the

small intestine should also be about 3 inches long and should be placed in close proximity to the anti mesenteric border of the bowel

The second posterior continuous suture is now passed. It starts on the right side, i.e. the cardiac end of the gastric and jejunal incisions, and is introduced as a through and through all coats haemostatic suture, drawing together the full thickness of the stomach and jejunal wall into a firm posterior ridge. The needle as it passes to and fro should pick up first the gastric mucous membrane, then the seromuscular coat of the stomach, then the seromuscular coat of the jejunum, and finally the mucous membrane of the jejunum. It is passed without interruption or locking, but when it has been inserted for its full length posteriorly it is locked and then laid aside.

The exposed stomach mucous membrane is now picked up with forceps and divided with scissors for the full length of the incision, and after all gastric contents have been removed by aspiration the jejunal mucous membrane is similarly divided. The third posterior continuous suture, which approximates the cut posterior margins of the gastric mucous membrane and of the jejunal mucous membrane also, starts at the right side of the stoma and finishes at the left side, i.e. at the pyloric end.

When this suture reaches the corner, it is continued anteriorly as the first anterior continuous stitch where it unites the cut anterior margins of the gastric and jejunal mucosæ, being finally tied to the end which was left long.

The second posterior suture is once again picked up and carried anteriorly from left to right as a second anterior suture. It is passed as a continuous Lembert

stitch, picking up the seromuscular coats of the stomach and jejunum, and when it reaches the starting point it also is tied off and cut short. Finally, the first posterior continuous suture is introduced anteriorly as the third anterior continuous suture, and this stitch is passed as a Cushing right angled stitch which not only neatly invaginates the anterior suture line and reinforces it but also ensures an extensive cohesion between the greater curvature and the proximal jejunum thereby preventing any kinking of the bowel near the large and newly fashioned gastro enteric stoma.

There are, of course, many variations of this operation. Thus the stoma may be placed transversely on the anterior wall of the stomach, above its omental attachment. Again, the stoma may be fashioned along an oblique line which extends from the incisura downwards to the greater curvature close to the pyloric end of the stomach, or again an ante peristaltic anastomosis may be made or enterostomy clamps may be used, or finally only two rows of continuous sutures may be employed in performing the short circuiting operation. As, however, the method here described has yielded good results, it is the one recommended on account of its simplicity and of the security it affords.

At the completion of the anterior gastro jejuno stomy it is customary to perform Braun's entero enterostomy, i.e. a lateral anastomosis made between the proximal and distal jejunal limbs. It should be stated that if the jejunal loop selected for the anastomosis is a long one, Braun's method is advisable to prevent waterlogging of the bowel and vicious circle vomiting. If, on the other hand, a short jejunal loop

has sufficed, the added short circuiting operation is, in my opinion, superfluous. When an entero entero stomy is necessary it is best made 2 inches or so distal to the duodeno jejunal flexure, in other words, as far removed as possible from the gastro enteric stoma. The opening which is made between the proximal and distal jejunal limbs should on the completion of the operation be just large enough to admit the tip of the index finger.

It must be stressed that anterior gastro jejuno stomy should not be employed in the treatment of uncomplicated and non obstructive duodenal ulcer. It has its chief sphere of usefulness in irremovable growths of the pyloric segment of the stomach and in those cases of pyloric stenosis due to extensive scarring in which achlorhydria or hypochlorhydria is present, but in which posterior gastro jejunostomy is not a feasible undertaking and partial gastrectomy is considered to be too severe a measure for the patient's strength to withstand.

CHAPTER IX

OPERATIONS FOR HOUR-GLASS STOMACH DUE TO CHRONIC GASTRIC ULCER

IN hour glass contraction the stomach is partitioned off into two, and in exceptional cases into three, compartments. The stricture or strictures which are responsible for this subdivision of the stomach may occur at any point between the cardiac and pyloric orifices. Hour glass stomach may, of course, be caused by conditions other than peptic ulcer. For instance, it may be seen in cases of cancer of the stomach in syphilitic or tuberculous ulceration of the stomach or after corrosive poisoning. The following details solely concern hour glass stomach when produced by chronic gastric (peptic) ulcer. Hour glass contraction occurs in approximately 10 per cent of all chronic gastric ulcer cases and over 90 per cent of the patients are elderly women. Perforation and haemorrhage are very rare complications.

Treatment

In certain rare cases where there is radiological evidence that the ulcer has healed, where the patient although not gaining in weight is certainly not losing weight and especially where vomiting is an infrequent symptom and is capable of being controlled by gastric lavage, dieting and medicines, and where the isthmus is large enough to admit the passage of solid food, medical therapy may be persevered with for an indefinite period, but in the majority of these cases surgical interference is indicated after a preliminary course of pre operative

treatment conducted on the lines laid down for organic pyloric stenosis

Operations for Hour-Glass Stomach

The following operations have been performed for this complication

1. Gastro-jejunostomy· (a) single (anterior or posterior), (b) double (anterior or posterior)—Weiss and Foote.
2. Gastroplasty (a) Heineke-Mikulicz; and (b) Kammerer
3. Wedge-excision of the ulcer followed by transverse gastro-jejunostomy and pyloric occlusion—Walton.
4. Sleeve or segmental resection of the stomach—Riedel-Rodman.
5. Gastro gastrostomy.
6. Partial gastrectomy· (a) Billroth I methods, (b) anterior or posterior Polya methods

Choice of Operation for Hour-Glass Stomach

Single gastro-jejunostomy is sometimes performed for hour-glass stomach, and more especially when the ulcer is situated in the pyloric segment of the stomach and the distal loculus is small; but the results following this operation have, on the whole, been disappointing. It should be remembered that a large number of chronic ulcerative lesions of the antrum or pyloric canal are primarily malignant in nature and that gastro-jejunostomy without excision of the ulcer is seldom productive of good results in the treatment of simple ulcer of the stomach. Double gastro jejunostomy is a pernicious operation, whether performed by the anterior or by the posterior route.

The immediate and late results of this method of Weiss and Foote have been extremely bad. Gastroplasty by the Heineke Mikulicz method has been abandoned, as the lengthy longitudinal incision (which is closed in the transverse axis) has to be made through the scarred isthmus and subsequent contraction takes place after the operation, giving rise to further constriction and obstructive symptoms. The same may be said of Kammerer's operation, which is the application of Finney's pyloroplasty to the stomach. Here, too, a portion of the horse shoe shaped incision in the gastric wall is necessarily carried through scarred tissue which subsequently contracts and narrows the stoma which has been made between the two gastric pouches.

Walton's wedge or V excision of the ulcer combined with transverse gastro jejunostomy and pyloric occlusion is very rarely practised, as it is a difficult operation to perform and the late results are inferior to those of gastro gastrostomy or partial gastrectomy.

Sleeve resection has little to recommend it except perhaps its simplicity and the protection it affords against perforation, haemorrhage, and malignant degeneration of the ulcer. In this operation a cuff of stomach, including the ulcer, is resected and end to end anastomosis between the proximal cut end and distal cut end of the stomach is carried out as in the operation of gastro jejunostomy. The drawback to this method is that contraction is prone to occur at the suture line, giving rise to a degree of mid gastric constriction and thus to troublesome dyspeptic symptoms which are attributable to interference with gastric function.

Gastro gastrostomy, i.e. the anastomosis of the two gastric loculi over the isthmus, is a simple undertaking and is recommended when the patient is in very poor condition and when the upper pouch is relatively small, is lying high up, and is somewhat inaccessible. It is the procedure of choice when partial gastrectomy is not a feasible undertaking on account of the general and local conditions present. The operation may be performed with or without the aid of enterostomy clamps. I generally carry out this operation without the aid of clamps and in the following manner:

The two gastric loculi are mobilized and Allis forceps are applied to the lesser and greater curvatures of the upper gastric loculus, and also to the lesser and greater curvatures of the pyloric pouch in a similar manner so that the two anterior folds of stomach wall can be drawn together and laid side by side without tension over the isthmus and over the scarred or ulcerated area. The two vertical pouches are drawn through the wound, isolated, and anastomosed together as in the operation of gastro jejunostomy, three layers of sutures being used. At the completion of the operation the omentum is drawn over the sutured area to prevent the stomach from becoming adherent to the anterior abdominal wall.

Partial gastrectomy should, where possible, be the method selected in the treatment of hour glass contraction due to simple ulcer, nor is it in the majority of cases a difficult undertaking as the patients are usually thin, the ulcer—contrary to expectations—is often small or healed, the stomach is frequently long and J shaped, and the operation can be conducted leisurely under local anaesthesia. If the ulcer is found

to be large and fixed to the capsule of the pancreas, the viscus can be cut adrift from the penetrating lesion, which is left *in situ*, and gastrectomy can then be carried out by either the Billroth I or the Polya method.

The operative death-rate of partial gastrectomy for hour-glass stomach is low and does not exceed 4 per cent., and the immediate and late results are exceedingly good as the patients rapidly gain in weight and in strength and are able to take ordinary diet as soon as the convalescence stage is over. In a personal series of 17 cases there were no hospital deaths.

The technique of partial gastrectomy for simple peptic ulcer is described in Chapter XII.

CHAPTER X

THE PYLOROPLASTIES AND GASTRO-DUODENOSTOMIES

THE operation of pyloroplasty aims at overcoming gastric stasis by longitudinal division or partial excision of the pyloric sphincter muscle, by excision of an anterior wall duodenal ulcer, and permitting a free regurgitation of alkaline juices through the newly fashioned gastric outlet. All pyloroplasties are thus gastro duodenostomies, but in Jaboulay's sub pyloric short circuiting operation the outlet of the stomach itself is ignored or oversewn and then side tracked. The pyloroplasties of Horsley, Judd, and Finney will first be described, after which an account of the Jaboulay operation will be given.

Horsley's Pyloroplasty

Horsley (*J A M A* '73, 575, 1910) considers that his procedure is 'physiologic' because it has the advantage of removing an ulcer in the first portion of the duodenum and at the same time of restoring gastric function to normal without any undue mutilation. Horsley himself states that his plastic operation has a *very* limited field of usefulness and should be reserved for ulcers which, although proving intractable to medical measures, are found at operation to be small and situated anteriorly close to the pyloric sphincter muscle, there being no surrounding inflammation or adhesions. He points out that extensive adhesions, sub acute inflammation around the ulcer, deformity of the bulb due to the contracting scar

tissue, the presence of a penetrating posterior-wall ulcer, and an attendant duodenitis are all definite contra-indications to his method. As surgery for chronic duodenal ulcer is indicated only in the presence of complications or for long-standing recalcitrant callous lesions, it is self-evident that the type of ulcer—small, on the anterior wall of the duodenum, close to the pylorus, producing no obstructive symptoms—for which Horsley's operation would seem to be indicated, is nowadays very rarely encountered when the abdomen is explored.

It must once again be emphasized that the treatment of chronic non obstructive duodenal ulcer associated with repeated attacks of dyspeptic symptoms is primarily medical. Failure to bring about a cure in these cases is an imputation against the measures which have been applied. Recurrence of symptoms is not a plea for surgical treatment but rather a demand for more efficient medical management.

Should there, however, be some unquestionable reason for advising surgical measures for a non-stenosing lesion, at operation one would expect to find a duodenum ravaged by disease—scarred, deformed, fixed by adhesions, and friable with the products of inflammation, and not a simple, small, circumscribed, mobile, suitably placed anterior wall ulcer.

Should a small non obstructive duodenal ulcer demand surgical inquiry on account of obstinate symptoms, it then also demands radical measures for its cure, in which event the procedure most likely to yield a permanently satisfactory result is partial gastro duodenal resection and not a simple juxta-pyloric plastic procedure.

Horsley's pyloroplasty may, nevertheless, be recommended when following a cholecystectomy, appendicectomy, &c, a small uncomplicated ulcer is found on the exposed wall of the bulb near the pylorus, and when carried out in such cases the late results appear to be tolerably good

Horsley, in his work, *Surgery of the Stomach and Duodenum* (1933), laid special emphasis on the following points in the conduct of his operation

- 1 Free mobilization of the duodenum
- 2 The duodenal incision must be not more than 1 inch long, while the gastric incision should be about twice this length to ensure complete division of the muscular fibres encircling the pyloric canal
- 3 Conversion of a longitudinal into a vertical incision rendering the pylorus widely patent
- 4 The sutures on the gastric side should penetrate the seromuscular coats and not the mucosa, while the sutures on the duodenal side should pick up all the coats of the gut

The incision is made through the anterior wall of the stomach precisely midway between the greater and lesser curvatures and at a corresponding point in the duodenum. Allis forceps placed at the extremities of the proposed incision should help to draw the pylorus and duodenum fully up into the wound. The incision in the first instance is made only through the seromuscular coats of the stomach and duodenum, down to, but not through, the mucosa. All bleeding points are caught with artery forceps and ligatured. The mucosa is then incised, the gastric contents are aspirated, and the thickened ring is divided, after which the ulcer on the anterior wall is cut away to-

gether with an ample surrounding rim of healthy tissue

If a penetrating posterior wall ulcer is found, the operation should be abandoned and partial gastroduodenal resection be substituted

The longitudinal incision is then made vertical by drawing together the two extremities with a suture which, on the gastric side, picks up only the seromuscular coats but on the duodenal side penetrates all the coats. This stay suture also acts as a tractor while the incision in the gut is being sutured. The now vertical wound is then closed with two layers of continuous sutures, special pains being taken, as previously stressed, to avoid injuring the gastric mucosa or including it in a stitch. The first suture starts at the inferior end of the wound and is a simple through and through stitch which, as it is inserted, draws together the seromuscular coats on the gastric side and all the coats on the duodenal side. When the divided end of the pyloric sphincter is reached at the lesser curvature, this stitch penetrates the entire thickness of the duodenal wall and is knotted. The second and outer row of sutures is of the Cushing type, which invaginates the stumps of the pylorus and the first layers of stitches (fig. 19 [*A* and *B*])

At the completion of the operation the suture line is reinforced with adjacent portions of gastro-hepatic and gastro-colic omenta (fig. 19 [*D*])

Judd's Pyloroplasty

The first account of this operation was given by Judd (*Jl. Lancet*, 42, 381, 1922). He considered that this method was particularly indicated in young patients suffering from a small, easily accessible

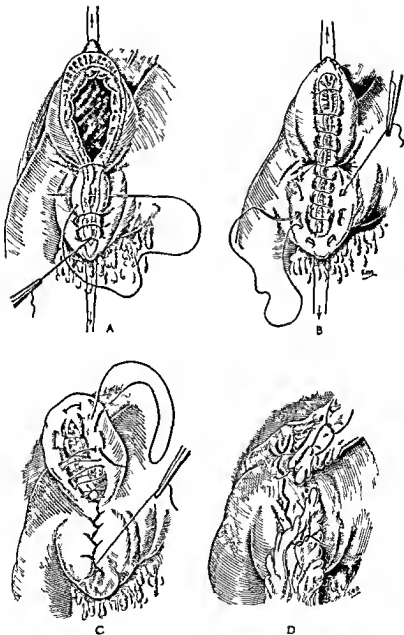


FIG 19 Horsley's Pyloroplasty

A First row of sutures begun

B First row of sutures completed

C Second row of sutures

D Operation completed

duodenal ulcer, and that the chief contra-indications to its performance were anchorage of the duodenum, marked narrowing of the gut due to scar formation, pouching from the production of false diverticula, the presence of a large eroding posterior-wall ulcer, and considerable dense fixation of peri-duodenal adhesions.

It will be seen, therefore, that the contra-indications are similar to those which prohibit the employment of Horsley's method. It has been claimed that this operation is a simple undertaking in cases for which it is indicated, that it can be carried out with a low mortality, i.e. about 1 per cent., that the late results are good, that protection is afforded against perforation, haemorrhage, and obstruction, and lastly that secondary ulceration occurs in only about 3 per cent. of the cases. Nevertheless, this pyloroplasty is rarely performed in Great Britain, and, as might be expected, the final results are on the whole definitely inferior to those of the older and simpler forms of anastomosis. The local difficulties, too, are by no means insignificant. When the operation is completed the stoma is clumsy, fixed, and under tension, while haemorrhage during the operation hampers its performance and leakage is not an unknown complication. Furthermore, gastric retention in the immediate post operative phase nearly always demands the institution of suction siphonage.

Technique of Judd's Pyloroplasty

This operation consists of mobilization of the duodenum and wide removal of the anterior two thirds of the pyloric sphincter muscle and adjacent portion of the antrum and also the anterior wall of the duodenal

bulb, including the ulcer (fig. 20 [1]) The union of the stomach and duodenum posteriorly is not incised. When this excision is completed, the openings at the distal end of the stomach and at the upper end of the duodenum appear like the openings of a gastro jejunostomy after the posterior layers of sutures have been passed (fig. 20 [2]) If a small shallow ulcer is found in the posterior wall of the duodenum, this may be cauterized. The gaping oval or circular aperture which results from this excision is closed in the transverse axis with two layers of continuous sutures, and the completed suture line is further reinforced with interrupted silk sutures and portions of adjacent omenta (fig. 20 [3]) It must be emphasized that the operation should be abandoned if a large fixed penetrating posterior wall ulcer is also found or if all the scarred tissue on the anterior wall of the gut cannot be satisfactorily removed, for unless the parts concerned in the anastomosis are healthy, a stricture may form at the line of suture and recurrence of ulceration is then liable to follow.

Finney's Operation

An excellent account of this method is given by Finney (*Surg, Gynec and Obst* 43, 508, 1926), and in his hands the late results of this gastro duodenostomy have been satisfactory. The operation, however, is not widely practised in Great Britain or in other European countries, although it has gained a measure of popularity in America. Most British surgeons prefer gastro jejunostomy to any form of pyloroplasty or gastro duodenostomy when a short circuiting operation is clearly indicated, and most of those who favour gastro duodenostomy usually choose the method of

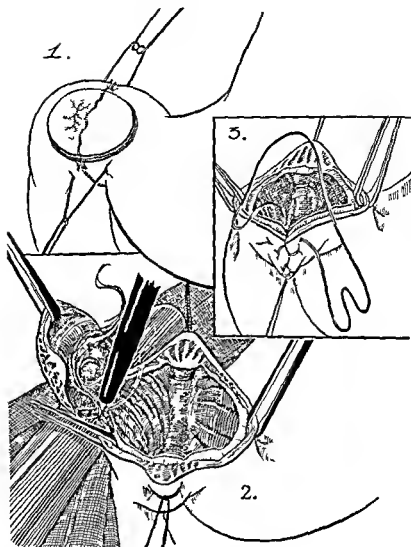


FIG 20 Judd's Pyloroplasty

- 1 Diagram showing the area to be excised
- 2 Excision of an anterior wall duodenal ulcer
- 3 Suturing of aperture in the transverse axis

Jaboulay (which at one time was popularized by Wilkie) on account of its ease of performance. Finney has claimed that his operation is more efficient than the limited pyloroplasties of Horsley and Judd in

that stasis is more completely overcome owing to the large stoma which is made, that the free regurgitation of alkaline juice into the stomach neutralizes acidity more readily, and that the final results are on the whole more uniformly pleasing

This operation, like the other plastic procedures described, is contra-indicated where extensive inflammatory adhesions exist, where a large penetrating posterior-wall ulcer is associated with a considerable degree of infiltration, oedema, and fixation of the gut, where the small omentum is thickened and the lumen of the duodenum is all but occluded, or where for any reason mobilization is difficult or when accomplished will not permit of the easy approximation of the duodenum to the stomach

It will be seen therefore that its main sphere of usefulness concerns the anterior-wall duodenal ulcers, in which the first and second portions of the duodenum are relatively mobile or can be rendered so by Kocher's method

There are two essential steps in the operation (1) thorough mobilization of the pylorus and the first and second parts of the duodenum, and (2) the making of an ample stoma

The stoma must be large and must extend well below the level at which the common bile duct enters the duodenum through the papilla of Vater, so as to allow of free and ready interchange of gastric and duodenal contents, thus counteracting any free hydrochloric acid which may be present in the stomach. Above all, it must be supple and free from any tension and be able to move easily with the contraction of its component parts

The operation is started by mobilizing the first and

second parts and the commencement of the third part of the duodenum and of the pylorus itself by Kocher's method. This is accomplished by dividing the peritoneum and fascia propria on the outer aspect of the duodenum, by freeing any adhesions which exist, and by stripping the bowel towards the middle line with gauze or by finger dissection. Unless a free and complete mobilization can be achieved, the operation should be abandoned, as recommended by Finney himself, who attaches the utmost importance to this preliminary step. When, therefore, the pylorus and duodenum have been freed and the abdominal field is packed off, three sutures of fine silk are passed to act as guides and tractors. The first is introduced close to the greater curvature of the stomach at a point about $3\frac{1}{2}$ inches below the pylorus, and this picks up a corresponding point on the inner border of the duodenum just about where the second part merges into the horizontal third part (fig. 21 [*A. III*]). This suture is tied and clipped with a haemostat. The second suture is inserted immediately below the pylorus, while the third is placed midway between the other two, somewhere about the level of the ampulla of Vater. These sutures also are knotted and clipped (fig. 21 [*A. I, and II*]).

Two additional temporary sutures are next inserted, one at the uppermost border of the pylorus and the other about 1 inch below the first guide suture to sling to the buttons of a Lang's frame the portions of the stomach and duodenum to be anastomosed.

Traction is now made on the guide sutures while the first posterior continuous Lembert suture is introduced, commencing at the pylorus and ending just

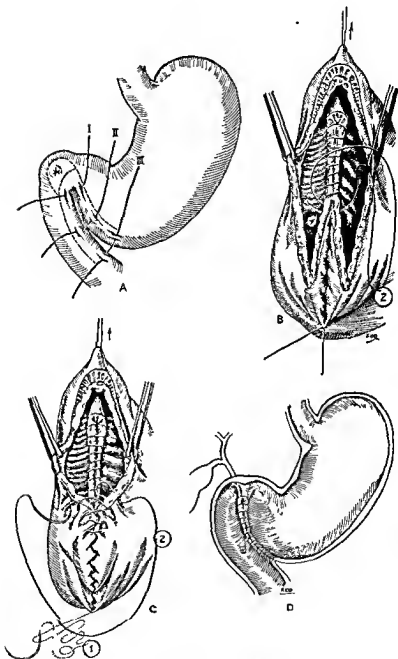


FIG. 21 Finney's operation.

A Sites of guiding sutures.

B Beginning of haemostatic suture.

C The Connel suture is shown drawing together the anterior cut margins of the stomach and duodenum.

D represents a cross section of the stoma at the completion of the operation. Note the position of the papilla of Vater.

below the first guide stitch. When this point is reached the suture is laid aside for the moment, to be used again later as the anterior invaginating stitch. An inverted U or horseshoe-shaped incision is made parallel with the posterior line of sutures through all the coats of the stomach, the pylorus, and the duodenum (fig. 21 [A]).

If an ulcer is found on the anterior wall of the duodenum, it can be cut away easily with scissors, and as much scar tissue as possible is removed with it. If, however, there is an ulcer on the posterior wall, it may be difficult to excise it. This is nevertheless possible by trimming away a triangular portion of the duodenal wall in which the ulcer is embedded. If a posterior-wall ulcer is found to be firmly fixed to the underlying pancreas, it may be burnt with a cautery or oversewn with cross stitches. The posterior through-and-through all-coats haemostatic suture is then applied, starting at the divided pylorus and proceeding downwards to the lower angle of the incision (fig. 21 [B]). From this point it is carried upwards without interruption as a Connel or loop-on-the-mucosa stitch, uniting the anterior cut edges of the stomach and duodenum and the divided pylorus, beyond which point it is tied (fig. 21 [C]).

The first posterior seromuscular suture is then taken up once again and continued anteriorly as a continuous Lambert suture to reinforce and to invaginate the first row of sutures. A few interrupted stitches of fine silk are placed here and there where the suture line requires strengthening, and adjacent tags of omentum are drawn across to prevent the gut from adhering to the parietal peritoneum, the liver, or the gall-bladder.

Jaboulay's Sub-Pyloric Gastro-Duodenostomy

Wilkie (*B M.J.* 1, 535, 1929), in reviewing 180 of his cases treated by this method, found that the results were excellent in 64 per cent ; 25 per cent. of the patients were relieved but not cured, and in 11 per cent symptoms of dyspepsia persisted. It may be stated that the final results of this operation are not so good as those which can be achieved by gastro-jejunostomy and are definitely inferior to those which obtain after partial gastrectomy. Therefore, in the treatment of chronic duodenal ulcer this operation would appear at the present time to be rarely indicated, although at one time it had the distinguished patronage of Moynihan, Wilkie, and Finney.

The operative steps are as follows. The duodenum is mobilized and two tractor sutures are inserted. The first suture is passed close to the greater curvature of the stomach just short of the pyloric ring, and picks up a point on the anterior wall of the duodenum immediately underneath the scarred area of the bulb. This indurated zone of the ulcer may be oversewn or left intact. The second stitch is introduced near the greater curvature about 3½ inches away from the pylorus, and picks up a point on the inner side of the lowest portion of the second part of the duodenum. When these sutures are tied and slung to the Lang's frame, the whole of the second portion of the duodenum and some 3 inches or so of the anterior wall of the vestibule of the stomach are drawn together side by side and are ready to be anastomosed.

Clamps are not used in the performance of this operation, and continuous sutures are used in making the anastomosis. The first is a seromuscular stitch which unites the adjacent portions of the stomach

and duodenum, while the second is a through and through haemostatic suture which is inserted after the stomach and duodenum have been incised. This latter stitch is carried anteriorly after the posterior sutures have been inserted, and approximates the cut anterior edges of the stomach and duodenum, while the first stitch further invaginates the anterior suture line.

If at the completion of this type of gastro duodenostomy the stoma appears to be unduly small, or if owing to inadequate mobilization there is compression, rotation or other evident mechanical defect at the site of anastomosis, it is sound practice to supplement the procedure by performing posterior gastro jejunostomy.

From the foregoing remarks it will be seen that these juxta pyloric operations, although at one time widely practised in America in the treatment of anterior wall duodenal ulcers never found popularity to any extent in Great Britain and that the indications for their use to day are very limited.

CHAPTER XI

WEDGE- OR CAUTERY-EXCISION OF A GASTRIC ULCER COMBINED WITH GASTRO-JEJUNOSTOMY

A VARIETY of operations are employed in the treatment of gastric ulcer, depending upon the patient's condition and the nature and position of the ulcer. These include

- 1 Partial gastrectomy
- 2 Simple excision of the ulcer
- 3 Gastro jejunostomy
- 4 Sleeve resection
- 5 Excision of the ulcer combined with gastro jejunostomy

The operation of choice for chronic gastric ulcer is *partial gastrectomy*, and with increasing experience on the part of the surgeon this method is applicable in over 85 per cent of cases. It ensures a wide removal of the lesion (which may be undergoing malignant change) and a permanent reduction in the acid values of the gastric juice, and also provides the maximum protection against recurrence of ulceration. In competent hands this operation is associated with an operative death rate of 2-5 per cent, while fully 90 per cent of the patients who survive the operation are restored to sound health, good digestion, and full economic efficiency. I prefer the Polya types of partial gastric resection to the Billroth methods of repair, although these latter can be readily and satisfactorily carried out when the ulcer is situated in the pyloric segment of the stomach and the duodenum is large and mobile.

Simple excision of a chronic gastric ulcer is, on the whole, an unsatisfactory operation, as the motor functions of the stomach are often thereby impaired, and apart from removing a possible source of malignancy and safeguarding the patient against perforation and haemorrhage, conditions within the stomach are not materially improved—acidity is not diminished, stasis due to pylorospasm is not overcome, and the newly fashioned suture line—although tidier than the previous ulcerated area, is longer and is prone to suppurate, leading to the formation of a new ulcer at this site.

It is the general experience of most surgeons that the results of simple excision are bad in fully 50 per cent of the cases. Nevertheless, I have in a few instances made use of this operation, especially where the patient has been aged and debilitated, where the ulcer has been situated in the anterior or posterior wall of the body of the stomach and did not encroach upon the pyloric segment or upon the greater or lesser curvature, and when, during excision with a knife or cautery, all the searred gastric wall was capable of being successfully removed. I believe that if simple excision can be carried out without interfering with the normal peristaltic movements of the stomach, it will continue to be used with a measure of benefit, especially when the patient's condition does not permit of a more extensive operation.

Gastro jejunostomy alone may, as I have previously pointed out, be called for when the patient's condition and age, or the high, inaccessible position of the ulcer, prevent a more extensive procedure. It is indeed a poor alternative to partial gastrectomy, as it does not remove the lesion, which may fail to heal

even after a short circuiting operation. Again, there is the possibility that the ulcer which has been ignored may be malignant in character.

Sleeve resection of the segment of the stomach in which the ulcer is situated does little more than ensure a wide excision of the ulcer and adjacent gastric wall. It does not protect against subsequent ulcer or mid gastric narrowing, and is often followed by some disturbance of gastric peristalsis. It is for these reasons that this operation is so seldom performed nowadays. In Claggett's series (*Proc Staff Meet Mayo Clin* 15, 337, 1940) only 50 per cent of the cases investigated by him showed permanently satisfactory results.

Excision of a gastric ulcer by knife or cautery combined with gastro jejunostomy is a satisfactory procedure, although definitely limited in scope, satisfactory, because it accomplishes adequate removal of the lesion and at the same time controls gastric acidity, thus protecting against recurrence of ulceration. This method is only applicable to small or moderate sized ulcers which readily lend themselves to excision or to destruction with the cautery. If the ulcer is large or adherent, excision combined with gastro jejunostomy becomes a formidable procedure and should therefore not be attempted (fig 22). Small mobile ulcers of the greater curvature are not often seen at operations nowadays as they are of the type which respond satisfactorily to medical treatment. The gastric ulcers which demand operative treatment are the large, fixed ulcers which defy all attempts at healing by palliative measures and those in which it is difficult or even impossible to exclude the likelihood of malignant degeneration.

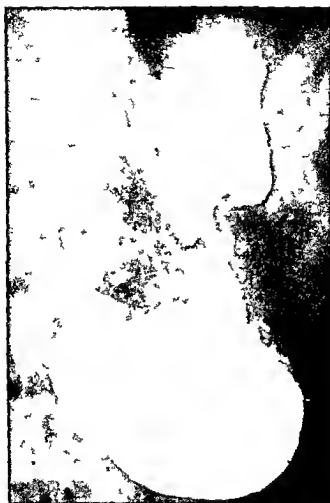


FIG. 22 Skiagram of a large gastric ulcer for which
 partial Gastrectomy was successfully performed
 (Dr Cecil Bull)

Wedge resection combined with gastro jejunostomy, has a lower death rate than partial gastrectomy even though it is technically more difficult to perform Joll (*Post Grad Med J* 12, 364, 1936) writes on this point as follows

'It is claimed for this method that it gives about 90 per cent of satisfactory end results, a figure

approximately equal to that for partial gastrectomy with the retro colic jejunal loop. It is right to point out that these two operations are not necessarily feasible alternatives, though there are, nevertheless, many cases which can be treated in either way. I do not think that there is anything to choose between the mortality of gastrectomy applied to cases which could equally well have been dealt with by wedge excision and gastro jejunostomy, since one is necessarily dealing with ulcers of moderate size which are fairly easily mobilized and which are not very near the cardia. My personal experience of the operation amounts to only 84 cases, but I employ it less and less and prefer gastrectomy.

In Walton's series (*Prognosis*, 1, 109, 1935) of 310 patients there were 13 deaths, a mortality of 4.2 per cent, and in a group, the members of which were observed for a period of 5 years or more, there were complete cures in 88 per cent of the cases. Of the total, 6 developed recurrent ulcers and 5 showed the later onset of carcinoma. Walton recommends that all small or moderate sized ulcers in the middle of the lesser curvature of the stomach which are manifestly benign in character should be treated by this method.

After the ulcer has been excised, the opening in the stomach is sutured, the pylorus temporarily occluded with a running silk suture, and a transverse gastro-jejunostomy performed, the stoma being placed parallel with the greater curvature and so arranged that one half lies proximal and the other half distal to the line of suture in the wound of excision.

The Technique of Wedge-Excision of a Chronic Gastric Ulcer combined with Gastro-Jejunostomy

Wedge excision of a gastric ulcer may be performed with or without the aid of intestinal clamps. I prefer to carry out the operation without clamps and conduct it as follows.

The lesser curvature is mobilized by dividing the middle portion of the gastro-hepatic omentum and by ligating and dividing the arteries fully 1 inch or even more on either side of the ulcerated area. Two pairs of Allis forceps are next placed on the posterior wall and two pairs on the anterior wall of the stomach so as to pick up a quadrilateral portion of the viscus, in the centre of which the ulcer is situated. The diamond-shaped area which is to be excised is first demarcated by cutting through the seromuscular layers with a knife, after which the stomach is opened and its contents are evacuated by means of a suction tube. The finger is then introduced into the stomach to palpate the crater of the ulcer and to estimate the amount of surrounding scarred and inflammatory thickening, and the ulcer is excised together with a healthy margin of the gastric wall. As a large defect remains after the lesion has been excised, it is better to start the suturing of the opening before the wedge is entirely removed, so that the suturing of the defect in the gastric wall may proceed simultaneously with the excision. A suture of No. 0/20 day chromic catgut mounted on an atraumatic needle is used to approximate the margins of the stomach, and when it reaches the top end, i.e. the posterior wall, it pierces all the coats of the apex of the incision, returning as a continuous Lembert suture which invaginates the

opposing seromuscular coats. When the suture arrives at the point on the anterior wall where it started, it is knotted and cut short. The suture line is reinforced and further inverted with a series of interrupted mattress sutures of fine silk, after which the oval gap in the omentum above the lesser curvature is closed, and the operation is completed by temporarily occluding the pylorus with a Mayo Kelling stitch, and a posterior transverse gastrojejunostomy is performed with the stoma as close to the greater curvature as possible.

The Technique of Cautery-Excision or Destruction of a Gastric Ulcer combined with Gastro-Jejunostomy

This method is termed Balfour's operation (*Surg Clin N Amer* 1, 5, 1921) and is reserved for those cases in which a small ulcer is found in the region of the lesser curvature near to the cardia or on the posterior wall in a somewhat inaccessible position where V excision may prove difficult to perform or where partial gastrectomy may for one reason or another be contra indicated. In such cases destruction of the ulcer by the cautery is a simpler, safer, and quicker method than wedge excision.

The portion of stomach in which the ulcer is situated is mobilized and its covering pad of lesser omental fat is dissected free until the base of the ulcer can be clearly identified. The stomach is then elevated and steadied with Allis forceps and the ulcer is completely destroyed with the point of a cautery. The opening in the stomach is then closed with catgut sutures and reinforced with a continuous suture of the same material, the suture line being covered over with

adjacent *gastro-hepatic omentum* to protect and conceal it as well as to constitute a barrier against the formation of adhesions which might interfere with the peristalsis of the stomach. Gastro-jejunostomy then completes the operation.

Balfour's method has much to commend it, especially for a small remote ulcer in a patient who is a poor surgical risk. The cautery burns away a minimal amount of gastric wall and the suturing of the defect does not interfere with the motility or functioning of the organ. In addition to this, the heat effectively destroys any malignant cells which may be present in the ulcer margins. Balfour employed this method in 296 cases with a mortality of 3 per cent, and obtained 85 per cent. of cures. Cancer of the stomach followed in 10 cases and recurrent ulceration in about 2 per cent.

CHAPTER XII

PARTIAL GASTRECTOMY FOR SIMPLE ULCER—POLYA TYPES

ALL partial gastrectomies are based upon the principles of the Billroth methods, being in fact descendants of the Billroth I and the Billroth II operations, which are resections with gastro duodenostomy or resections with gastro jejunostomy respectively

The technique of the Billroth I types of repair is discussed in Chapter XIV

The modern Billroth II operations are named after Polya. They may be *anterior*, when the proximal jejunal loop is brought over the transverse colon (ante colic) for anastomosis with the cut end of the stomach, or *posterior*, when the gastro enteric stoma is retro colic

The objects of all partial gastrectomies in the treatment of chronic peptic ulcers are

- 1 To remove an *extensive* area of the acid secreting portion of the stomach, the pyloric segment, and the major portion of the first part of the duodenum in order to reduce the acid production. In most cases the ulcer will be excised together with the portion of stomach which is removed
- 2 To make a new opening between the stomach and duodenum or between the stomach and proximal jejunum, to restore gastro intestinal continuity, and to permit of a free admixture of gastric and intestinal contents

These objects are achieved with brilliant success in a very high percentage of cases by both the Billroth methods as practised to day

It is most important to remove a large segment of stomach—often as much as two-thirds or even more. In the average case the proximal line of transection should extend from a point on the lesser curvature about 2 inches from the cardiac orifice, obliquely across the body of the stomach to a point on the greater curvature which is immediately proximal to the lower margin of the gastro-splenic omentum. The distal line of section will vary in individual cases.

It is desirable, although not always feasible, to excise the ulcer together with the major portion of the first part of the duodenum. When the ulcer can be freed from the adherent pancreas, or when the duodenum can with safety be dissected away from the ulcer which is left embedded in the pancreas, the distal line will cut across the duodenum just below the ulcerated area. But where the duodenum is so fixed to the pancreas by a deeply penetrating ulcer and inflammatory adhesions that duodenal occlusion would prove too hazardous an undertaking, the distal transection should be carried out through the antrum. When this latter method is enforced on technical grounds, Baneroff's procedure (*Amer J. Surg* 16, 223, 1932) of removal of the pyloric mucous membrane is undertaken. By this plan, after the cuff of pyloric mucosa has been bared to the gastric outlet, it is ligated inside the pyloric muscular sphincteric ring, the freed portion is cut away, the ligated stump is invaginated into the duodenum, the friable seromuscular funnel from which the mucosa has been stripped away is turned in and tightly sutured to act as a safe plug, and the operation is completed by the standard Polya procedure.

Most of the deaths which follow partial gastrectomy for duodenal ulcer are due to unnecessary, highly dangerous, and protracted dissections of the first portion of the duodenum or to the surgeon being misguided into believing that the cartilaginous like scarred and fused bulb is a stenosing pyloric cancer which must be amputated at all costs

In the case of gastric ulcer one of three conditions is commonly found at operation

- 1 The ulcer is situated at or near the lesser curvature of the stomach and is free and quite mobile,
- 2 The ulcer is adherent to the pancreas by fibrous adhesions—penetration has not yet taken place, or
- 3 The ulcer has deeply pitted the pancreatic substance, the posterior wall of the stomach being welded to its bed

Partial gastric resection is a straightforward procedure when the ulcer is of the non penetrating variety, but great skill and cautious dissection are required to separate the viscus from its adherent position when the ulcer is of the chronic perforative type In these latter cases during the mobilization of the stomach posteriorly its cavity is opened, the crater of the ulcer—or at least a portion of its base—is necessarily left behind in the sclerosed pancreatic tissue, and the hard ring of scarred tissue which surrounds the opening in the gastric wall represents the margins of the ulcer The ulcer on the exposed face of the pancreas must be assumed to be septic and to be undergoing malignant change It should therefore be cleansed with alcohol, lightly curetted, mopped dry, and cauterized, after which a portion of omentum should be drawn over the burned area and kept in

place with a few catgut stitches. At the completion of the operation, if there has been any oozing of blood from the charred zone, a small rubber drain should be led down to the lesion in the pancreas and left in position for 24 hours.

Provided the proximal transection has been sufficiently high, and that in the case of a duodenal ulcer it has been possible to mobilize the bowel satisfactorily, it would appear immaterial on *physiological* grounds whether the cut end of the stomach is anastomosed to the duodenum or to the jejunum, as both methods fulfil all requirements. Nevertheless, on *technical* grounds, and in view of the smoothness of the convalescence which follows the Polya types of gastric resection and anastomosis, I prefer these to the Billroth I methods of repair. I have during recent years occasionally performed the Billroth I operation for simple pyloric lesions associated with a duodenum which is capacious and mobile and for early malignant growths of the antrum in aged and infirm patients where an operation confined to the supra colic compartment could be carried out expeditiously.

I maintain that the Billroth I technique when employed in the treatment of *chronic duodenal ulcer* is open to the following objections.

1. The surgeon, unless he is experienced in this method, is often more concerned about an easy *approximation of the cut end of the stomach to the cut end of the duodenum* than with a wide resection of the stomach. I am fully aware that with an extensive mobilization of the greater curvature, even involving division of the gastro splenic omentum, and with a high ligation of the left gastric artery, the stomach is capable of considerable liberation

and that, after an ample resection, the remaining gastric stump can often be drawn without any appreciable tension right across the middle line to the duodenum itself. There is, as a rule, never any trouble in preparing the gastric stump for union with the duodenum. All the difficulties of this operation are centred around the duodenum itself.

2 As a result of long standing ulceration, the duodenum may be drawn down and be deeply hidden in the abdominal recess, shortened, distorted, and the seat of a widespread duodenitis. Again, even when it can be mobilized, the part which remains after the removal of the ulcer bearing area together with the surrounding zone of inflammation is always short, somewhat inaccessible, and difficult to approximate to the gastric snout. End to end union may be and often is a tedious and anxious undertaking in such circumstances.

3 When the anastomosis is completed, the parts often appear fixed, tense, and strained, a state of affairs incompatible with sound functioning. The secret of all good anastomoses is the making of a stoma which is supple and free to ride easily without interfering with the peristalsis of its component parts.

4 The duodenum is a thin walled, soft, friable structure and quite devoid of peritoneum on its posterior surface, and it is for these reasons that extraordinary precautions are taken when fashioning the stoma to prevent leakage, peritonitis, the production of a valve, or extreme narrowing of the new opening. The disproportion in the thickness of the walls of the stomach and duodenum is also a factor to be reckoned with when fashioning the stoma.

The proponents of the Billroth I operation maintain, however, that the duodenum, even when devastated by disease, is frequently capable of being adequately mobilized by methodical and painstaking dissection, and that when the suturing is carried out with due care the gastro duodenal stoma is of ample proportions and in no sense strained. They further claim that when an axial junction is not feasible owing to the extreme shortness of the duodenal stump which remains after the extensive gastro duodenal resection, lateral gastro duodenostomy by the von Harberer Finney technique is a preferable procedure to the Polya methods. Such exponents as Grey Turner, Dunhill, Walton, von Harberer, Waltman Walters, Morley Judin, and Finochietto all testify to the excellent results which follow the Billroth I operation in the treatment of chronic duodenal ulcer.

The opponents of *any* type of gastric resection for duodenal ulcer base their opposition on the following opinions:

- 1 That it is an unnecessarily mutilating operation for such a small lesion
- 2 That it is accompanied by an operative death-rate considerably higher than that of gastro jejunostomy
- 3 That it does not wholly protect the patient from possible subsequent stomal ulceration
- 4 That it is often followed by anaemia and decreased economic efficiency

In cases of chronic duodenal ulcer the resection which is carried out has to be radical as it is planned for acid reduction. It has been described as mutilating, but as Ogilvie suggests, *thorough* would be a more accurate word. The advocates of gastro jejunostomy

should remember that when this operation is performed it is *functionally* almost as radical as partial gastrectomy in that a considerable portion of the right half of the stomach is permanently thrown out of action and receives no food and that the pylorus ceases to function as a sphincter

The mortality of gastro jejunostomy for duodenal ulcer is about 1 per cent. It certainly should not be higher, since this operation may be regarded as a comparatively straightforward exercise in gastric surgery. It is commonly stated that the death rate of partial gastro duodenal resection for chronic duodenal ulcer is about 5-6 per cent. This may be so in the hands of certain surgeons, but those who are skilled in the technique of this operation can show a mortality equal to, or at worst only slightly higher than, that of the short-circuiting method. Thus, Roscoe Graham of Toronto had only two deaths in 135 cases (1.4 per cent). Engel (*Southern Surgeon*, 6, 231, 1937) states that Konnecke reported 468 resections with a 1.9 per cent mortality and that von Harberer in his last 100 consecutive cases had no fatalities. Pannett (*Surg, Gynec and Obst* 67, 485, 1938), by employing the Moynihan modification of the Polya method, reported 116 cases with but one death—0.86 per cent. In a personal series of 80 partial gastrectomies for duodenal ulcer there has been only 1 death.

Waltman Walters, Lewis, and Lemon (*Coll Papers Mayo Clin* 31, 70, 1940) state that in the 212 cases in which a posterior Polya partial gastrectomy was performed at the Mayo Clinic for chronic ulcer of the duodenum there was a mortality of 1.9 per cent.

The story is different when we consider the death-

rate from partial gastrectomy when performed for gastric ulcer. Here the surgeon has often to deal with a large penetrating lesion accompanied by considerable oedema and thickening of the gastro hepatic omentum in a patient who is debilitated and has probably passed through many courses of medical treatment

If we consider only the free mobile ulcers of the lesser curvature, partial gastrectomy has a mortality of about 2-4 per cent, but for the chronic perforative lesions the death rate can hardly be expected to sink to a figure lower than 5 per cent, although even this has been achieved during recent years both in the Mayo Clinic and in Lahey's clinic in Boston. My own figures show a mortality of 6 per cent for gastrectomy when carried out for chronic gastric ulcer, but I am confident that this figure can be lowered by improved and more intensive pre- and post operative treatment.

Gastro jejunal ulceration may, of course, occur after partial gastrectomy, in fact the incidence may be as high as it is after gastro jejunostomy if gastric resection is timorous, niggardly, and limited to the pyloric segment. Anastomotic ulcer occurs in approximately 1-2 per cent of cases following gastro-jejunostomy for cicatrizing duodenal ulcer associated with pyloric stenosis, but the incidence may be as high as 15-20 per cent when this short-circuiting operation is performed for the non stenosing types of chronic duodenal ulcer in young and middle aged patients. It is high, too, when the mucous membrane of the pyloric portion is left behind when performing the Finsterer type of 'physiologic' operation, i.e. partial gastrectomy with pyloric occlusion. This operation of Finsterer's is rarely carried out to day and has

been supplanted by Bancroft's method, in which in the presence of an irremovable ulcer of the duodenum the distal transection is made through the antrum, and the mucous membrane of the small remaining gastric stump is stripped away to the very outlet of the stomach before completing the pyloric occlusion. The gastric excision which follows is just as extensive as in the more formal Polya types of procedure. The incidence of jejunal ulceration following partial gastrectomy for duodenal ulcer is about 2-3 per cent, while for gastric ulcer it is less than 1 per cent. Engel states that Friedmann after a careful follow up in a series of 2 250 gastric resections found a recurrence of ulceration in 4 per cent of his earlier cases, but in only 0.5 per cent of those on whom he had performed a more radical type of operation. In Lahey's series of 200 sub total gastrectomies for simple ulcer there were 5 cases which subsequently developed gastro jejunal ulceration. The Mayo Clinic figures show that marginal ulceration occurred in 2.5 per cent of the total of 197 cases followed up after partial gastrectomy for duodenal ulcer.

Anaemia may occur after any type of gastric operation, including gastro jejunosomy, as Hartfall (*Guy's Hosp Reps* 84, 448, 1934) has so ably shown. He considers that the amount of stomach removed has no constant relation to the development of anaemia, and that the anaemia is dependent upon the functional disturbance produced by the operation in the particular case. He is also of the opinion that the presence or absence of free hydrochloric acid does not seem to affect the development of this condition, the incidence of which has been greatly exaggerated. The occurrence of macrocytic anaemia is extremely

rare and is more prone to follow total gastrectomy than any other type of gastric operation. The microcytic type of anaemia has rarely been encountered in my own series of cases, and when discovered has been rapidly cured by means of a generous diet containing a full vitamin content and by the administration of hydrochloric acid and ferrous salts over a short period.

The majority of my gastrectomy patients are back at work again within 3 months of the operation. They are then instructed to eat small meals at frequent intervals and to avoid alcohol and smoking, but later on they are allowed ordinary full diet and seem to experience no inconvenience or discomfort from this, in fact they rapidly gain in weight and in strength and lead normal lives without any special restrictions. As I have previously stressed it is fatuous to state that a patient who has had a partial gastrectomy performed for ulcer must be as careful as one who is under medical treatment since the one outstanding advantage of the operation is that it sets him free from all the trammels of invalidism. The final results leave little to be desired, and fully 90 per cent of the patients are restored to full economic efficiency. A few patients will complain of a sense of fullness after meals, of the sudden regurgitation of bitter bile into the mouth from time to time or of a temporary feeling of constriction in the chest. The sensation of fullness after meals is not due to the small size of the remaining gastric pouch, but rather to a technical flaw which permits of the entrance of gastric chyme into the afferent limb of the jejunum and then on into the duodenum, leading to a gaseous distension and overloading (fig. 23). This does not



FIG 23 X ray appearances of an unsatisfactory partial Gastrectomy with retro colic jejunal loop

The barium meal is seen leaving the small gastric pouch and freely entering the afferent and efferent limbs of the jejunum. There is some spasm of the stoma but no evidence of jejunitis or of jejunal ulcer. The patient complained of some discomfort after meals owing to distention of the duodenum with food. This could however have been prevented by fashioning an oblique gastro enteric stoma and by employing a longer afferent jejunal limb (Dr David Derry)

occur nor does bile regurgitation into the mouth take place if the stoma is correctly fashioned and if provision is made for the prevention of these unpleasant complications

Indications for Partial Gastrectomy for Chronic Peptic Ulceration

1 Those cases of non obstructive chronic duodenal ulcer associated with hyperacidity, hyperperistalsis, and hypersecretion, in which pain is difficult to relieve and relapses are becoming increasingly frequent and in which it is obvious that medical treatment, however skilfully applied, is ineffective

2 The *recurrent* type of spastic pyloric stenosis due to duodenal ulcer accompanied by hyperchlorhydria

3 Combined ulcers, i.e. the patient has a chronic gastric and a chronic duodenal ulcer

4 Bleeding penetrating posterior wall ulcer of the duodenum or stomach when general and local conditions permit

5 Recurrence of ulceration following an inadequate operation such as pyloroplasty

6 In cases of gastro jejunal ulceration when medical treatment fails to bring about a cure

7 In most cases of hour glass stomach due to simple ulceration

8 In cases of chronic penetrating gastric ulcer which shows no sign of healing within 3-6 weeks under efficient medical treatment

9 In all cases of ulcerative lesions of the greater curvature of the stomach

10 In those cases where an ulcerative lesion is present in the stomach and it is impossible by

radiology or gastroscopy to exclude the likelihood of cancerous change

11. In most cases of multiple chronic gastric ulcer.

The Technique of the Polya Operation

The first step in this operation consists in detaching the vascular epiploic arch intact from the greater curvature, thus preserving the blood supply of the great omentum. This detachment should extend from the inferior aspect of the pylorus to the lowest margin of the gastro splenic omentum where the left gastro epiploic artery turns across to the right. When this is completed, the medial border of the first and the commencement of the second portion of the duodenum are likewise stripped from all omental attachments. The greatest care is taken not to damage the right gastro epiploic artery where near its origin it curls beneath the pylorus to swing to the left to supply the greater curvature with numerous small radicles, to include it in a ligature, or to knuckle it when tying off the vessels which arise from its concave border. The blood-vessels which spring from the upper or concave side of the vascular epiploic arch are plentiful, stumpy, and small, while those from the convex side are few, long, slender, and much smaller in size. The detachment, which is always a slow process, may be effected in a number of ways. Thus, each blood-vessel or a small bunch of blood-vessels may be individually isolated, clipped in two places with artery forceps, divided, and then ligatured with silk, or a special curved director may be thrust under a small sheaf of blood vessels exactly midway between the main artery and the greater curvature and an aneurysm needle threaded with silk used to simplify

the tying off The blood-vessels are then tied tightly in continuity in two places and divided—tightly, because the ligatures may slip off while the stomach is being manipulated. This process of ligaturing and dividing many small blood-vessels is tedious but it is safe, and is repeated step by step until the whole vascular epiploic arch is liberated from the right side and then from the major portion of the left side of the greater curvature

The bared greater curvature is next picked up with the fingers and elevated, and the surgeon passes his right hand into the lesser sac to tear through the middle portion of the transparent gastro hepatic omentum with his fingers Through the opening thus made in the lesser omentum a long strip of gauze is passed and made to encircle the stomach and act as a sling or tractor. The posterior aspect of the pyloric segment of the stomach is brought into view by rotating the stomach forwards and upwards, and if the mesocolon is adherent at this site it should, together with the middle colic artery, be carefully stripped away by gauze dissection out of harm's way It is well to remember that this important artery or the arching anastomotic branch of the right colic artery is often fastened to the under aspect of the stomach by thin adhesive membranes and that during the mobilization of the stomach, or rather its pyloric end, these vessels should be constantly kept in view and protected from any injury.

When the operation is being performed for chronic gastric ulcer, the freeing of the first portion of the duodenum and its preparation for transection and closure present no special difficulties, but in cases of duodenal ulcer it may be, and often is, an arduous and

painstaking procedure. Some surgeons consider that a quicker and better mobilization of the stomach and duodenum can be effected by opening the lesser sac below the lowest point of the greater curvature through an incision in the gastro colic ligament, by dividing the various adhesions which bind the stomach to its bed, by stripping away the mesocolon and its contained vessels from the under surface of the pyloric segment, and by ligating and dividing the great omentum, piece by piece, below the main vascular epiploic arch and by tying off and severing both epiploic arteries. The main objection to this method is that it necessarily deprives the great omentum of its blood supply, with the result that this important structure partly necroses and atrophies. It is for these reasons that in partial gastrectomy for simple ulcer I make a special point of preserving the great omentum and its blood supply.

When the great omentum has been freed from the greater curvature and when the gauze sling is in position, the surgeon should proceed with the next step in the operation.

The first portion of the duodenum and the pylorus are now mobilized by isolating and underrunning the numerous vascular bands and adhesions on the superior, inferior, and posterior aspects of the bowel. The adhesions which exist posteriorly are isolated with a director or with long, slender, non-toothed dissecting forceps prior to ligating and dividing them one by one (fig. 24). When a posterior wall ulcer is bound down to the pancreas, the dissection must proceed cautiously or the pancreas may be inadvertently injured or a sharp haemorrhage be produced by the laceration of a large vessel. There are numerous

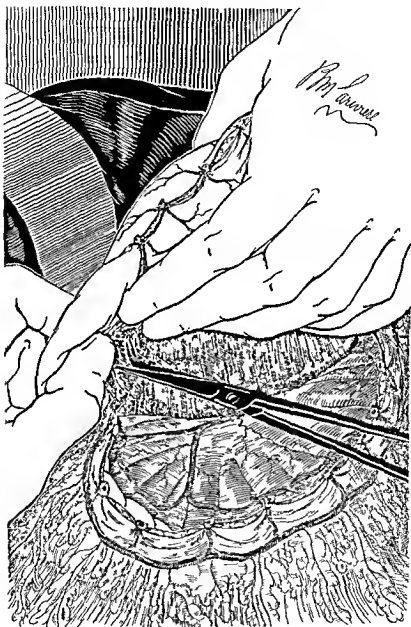


FIG 24 The Polya operation

The vascular epiploic arch is preserved The adhesions which bind the first part of the duodenum to the head of the pancreas are being freed

unnamed arteries which arise from the bed of the pylorus and which lie concealed in dense stumpy fibrous bands, and each of these requires individual attention, separation, and ligation. The mobilization of the duodenum is facilitated by ligaturing and dividing the right gastric (pyloric) artery and the supra duodenal artery of Wilkie. These fan shaped arteries should be tied off with strong silk and divided close to the superior margin of the first part of the duodenum. If a small posterior wall ulcer has penetrated deeply into the pancreas, the duodenum should be dissected free, leaving the base of the ulcer adherent to the substance of the pancreas, where it can be swabbed dry and destroyed with an electric cautery. If a large penetrating posterior wall ulcer has widely excavated the pancreatic head and has encroached upon the vital second portion of the bowel, discretion would advise abandonment of a laborious and dangerous dissection in favour of Baneroff's plan of pyloric transection.

It is necessary to free the duodenum for at least $\frac{1}{2}$ inch beyond the ulcerated area in order to leave sufficient healthy tissue for a generous inversion of its cut end. If this cannot be done owing to the great size of the ulcer or to the marked foreshortening of the first portion of the duodenum—the result of excessive contraction and scar tissue and of peri duodenitis—then it is better to play for safety.

Duodenal fistulae, damage to the lower end of the common bile duct, acute pancreatitis, subphrenic abscess, and spreading peritonitis are some of the legacies of obstinate adherence to a prearranged plan of action. Success does not wholly depend upon occlusion of the duodenum beyond the ulcerated

area, it does not depend upon removing the ulcer intact, nor upon its destruction with the cautery when it lies embedded in sclerotic pancreatic tissue, but rather upon an extensive resection of the acid bearing portion of the stomach together with the pyloric mucous membrane and upon forming a well fashioned and supple gastro enteric stoma.

In the treatment of chronic duodenal ulcer, gastrectomy with pyloric occlusion yields results almost if not equally as good as gastrectomy with duodenal occlusion, always provided that in the former operation the pyloric mucous membrane is removed. I must repeat that it is desirable, although not always technically possible, to mobilize the first portion of the duodenum when it is the seat of long standing ulceration. When the duodenum can be adequately mobilized, it is cut across just below the ulcerated area and its distal end is securely closed.

There are many ways of dividing the duodenum and closing its distal end.

- 1 When the duodenum is so much shortened as the result of old scarring or the ulceration has encroached upon the second part to such an extent that it is impossible to effect closure with the aid of clamps or special instruments, it is best to divide the bowel directly below the ulcerated area or below the gaping hole in the posterior wall where the ulcer was situated and to close the open end of the duodenum with a Connel suture (loop on the mucosa stitch), and when this is accomplished, to reinforce the suture line with a series of Halsted sutures of silk and pads of adjacent omenta.

- 2 When the first portion of the duodenum can be readily mobilized, the Mikulicz method of closure

may be employed. By this plan two clamps are placed on the duodenum, side by side, distal to the ulcer, and the bowel is divided between them with a cautery or carbolyzed knife.

After the transection the clamp on the gastric side of the duodenum is surrounded with a waterproof square and drawn well over to the left away from the field of operation, while the other clamp is rotated laterally to expose the under surface of the duodenum. This will permit of a little further mobilization of the duodenal stump, which is then sutured over with a right angled Mikulicz stitch, this being drawn taut as the clamp is released. When this stitch is tightened, the cut margins of the duodenum are neatly inverted. The stitch is then carried back to its starting point as a Cushing suture and tied tightly, producing a slight purse string effect. Here again the suture line is reinforced with a few interrupted silk sutures and pads of omental fat (fig 25 [*A* and *B*]).

3 Another method consists in inserting a purse-string suture of silk around the lower portion of the first part of the duodenum, after which the duodenum is crushed with a clamp slightly distal to the ulcer and a stout ligature is tied in the crushed groove. Three pairs of Allis forceps are next applied to the duodenum beyond the purse string suture to steady it, a clamp is applied $\frac{1}{3}$ inch proximal to the ligature, and the duodenum is divided with a knife or cautery. The duodenal stump is now invaginated with non-toothed dissecting forceps and the purse string suture is tied. Another purse string suture is introduced to invaginate the stump even farther, and adjacent portions of omenta are anchored over the stump to afford further protection (fig 25 [*C* and *D*]).

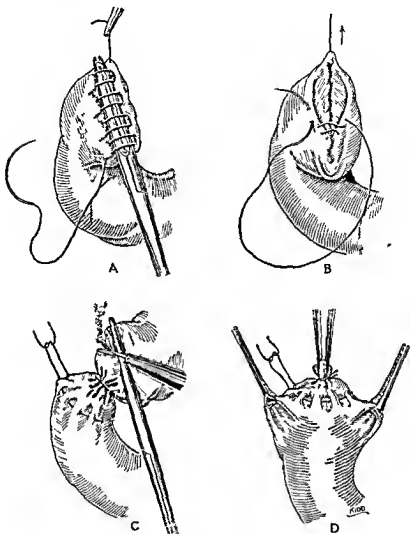


FIG. 25. The Polya operation.

Closure of the duodenal stump by the Mikulicz method (A and B) and by the method employed by Fusterer (C and D)

The left gastric (coronary) artery must now be securely tied and divided. In cases of duodenal ulcer this presents no difficulties, but in gastric ulcer, owing to inflammatory thickening and oedema of the lesser omentum, to the presence of swollen inflamed lymph

nodes along the lesser curvature, to fixation of the stomach to the liver or pancreas by an eroding ulcer, and to surrounding adhesions, it is often a most difficult dissection

The stomach must in every instance be freed posteriorly from its bed before the artery can be safely isolated, and this may entail cutting across the walls of a penetrating ulcer and leaving the crater behind in the pancreatic substance. Sometimes infiltrating the gastro-hepatic omentum high up on the lesser curvature with a little weak novocain solution will facilitate the isolation of the artery. In order to obtain the optimum view of the artery the surgeon should draw the stomach downwards and rotate it outwards towards the left. In this way the lesser curvature is put on the stretch and the remnants of the lesser omentum with its contained blood-vessels stand out in bold relief.

The index finger of the left hand is now passed beneath the vascular pedicle and made to bulge the gastro-hepatic omentum at a point just lateral to the free margin of the vertical portion of the lesser curvature about 2-2½ inches below the cardiac orifice, and a pair of dissecting forceps or a haemostat is worked through at this point until it can be passed between the lesser curvature and the main vascular pedicle. Through the opening thus made an aneurysm needle threaded with strong silk is slipped and the ligature is worked downwards towards the aorta and applied to the artery as close to its origin from the coeliac axis as possible. Another ligature is likewise passed through the rent and tied near the stomach wall, after which the left gastric artery and accompanying veins are cut across with scissors. The three clamp method

may also be employed for securing these important blood-vessels and consists in applying three haemostats side by side to the vascular pedicle after it has been displayed by a little dissection. The blood vessels are divided between the distal (i.e. the one next to the lesser curvature) and the middle haemostat. The proximal pair of artery forceps (i.e. the one next to the aorta) is removed, leaving the middle one in position, and two ligatures are slipped into the crushed groove and firmly tied in place.

After the left gastric artery has been divided, the glands along the lesser curvature together with their fatty envelope are stripped downwards for a short distance, thus exposing a small raw area on the lesser curvature. I make a point at this stage of re-peritonizing this raw surface before proceeding with the further steps of the operation. This may be done with a running suture of fine catgut or a series of interrupted silk sutures (fig. 26). The stomach will now be freely mobile and ready for anastomosis with the jejunum.

At this stage the surgeon has to decide whether the anastomosis should be made *ante colic* or *retro colic*, whether the proximal end of the selected jejunal loop should be applied to the lesser curvature or to the greater curvature of the stomach, and whether the upper portion of the cut end of the stomach should be closed or whether the whole of the cut end of the stomach should be utilized for fashioning the new stoma. Theoretically, it is better to make the stoma posterior or *retro colic*, as a shorter loop of proximal jejunum can be employed with the obvious advantage that the stoma is thus closer to the duodenum. In practice, however, it may sometimes be impossible to



FIG 26 The Polya operation

A retro colic anastomosis is being fashioned

make use of this retro colic method when the meso colon is laden with fat which obscures the middle colic

blood-vessels, when it is short, when the vascular arches are numerous and *bizarre* in formation, or when inflammatory or developmental adhesions fasten the first few inches of the proximal jejunum to its surface. In such cases the surgeon should not hesitate to employ the anterior method of anastomosis, as it is simple and efficient and yields results which are equally as good as those which follow the retro-cole method

When the *anterior* method is chosen, the transverse colon is drawn upwards through the wound to display its under-surface and the duodeno jejunal flexure. It is always a wise precaution to identify the duodeno-jejunal flexure by sight, after which the first 12 inches or so of the commencement of the jejunum are drawn through the abdominal incision. The great omentum and transverse colon are then tucked away beneath the liver and into the now empty stomach bed, and when this is done the stomach and jejunum are prepared for anastomosis. In my opinion it is better to apply the proximal end of the segment of jejunum selected for anastomosis to the lesser curvature rather than to the greater curvature, as the small gastric segment which remains after gastrectomy is to all intents and purposes an inert pouch devoid of strong peristaltic movement, and the food and fluids which enter it spill over by force of gravity towards the greater curvature and enter the intestine in this region

When the stoma has been fashioned as I suggest, nourishment is transferred directly into the long tube of intestine, where it readily passes on to the coils below. When, however, the proximal end of the jejunum is applied to the greater curvature, as it is by the

Moynihan method, most of the food soon finds its way into the duodenal cul de sac where, on account of its bulk and fermentation, it distends the gut and gives rise to many unpleasant sensations such as epigastric distress and bloating, tightness, and even colicky pains. This distress passes off in time when the duodenum rejects its heavy glutinous and gaseous contents back into the stomach and the patient belches up a quantity of wind. For this reason the loop is applied from the right to the left across the stomach with the proximal end to the lesser curvature and the distal end to the greater curvature.

How long should the proximal loop be? The length of the loop is measured from the duodeno jejunal flexure to the proximal point in the anastomosis, i.e. from the flexure to the lesser curvature. The length will, of course, vary in individual cases, but it must never be so short as to cause dragging or tension at the line of suture, flattening of the loop, compression of the colon when the anterior method is employed, or *linking* of the gut at the mesenteric root or at the lesser curvature, or as to prevent the gastric segment from freely riding upwards towards the diaphragm at the completion of the operation. A loop which is too short has two inherent dangers: (a) peritonitis from leakage, and (b) obstruction from the factors enumerated above.

The loop must not be too long or the proximal jejunum will become overloaded and have great difficulty in emptying itself through the gastro enteric stoma. Vomiting is the bugbear of the long loop. The loop must never be so long that an entero anastomosis becomes obligatory, since through this secondary opening the alkaline juices are shunted

into the intestine away from the newly fashioned gastro enteric stoma which now receives the full force of the acid bath

It follows from this that great importance is attached to choosing, and choosing wisely, the exact place in the proximal jejunal loop for the making of the anastomosis. In the average case the length of loop is about 4-6 inches when the retro colic route is chosen, and 7-12 inches when the anterior anastomosis is being undertaken. The loop must be free and easy, there must be a great deal of slack, the parts engaged in the anastomosis must lie comfortably together without any tension, the proximal portion of the loop must curve gracefully upwards to its point of attachment to the lesser curvature, and the 'new' stomach must be capable of sliding upwards towards the deep recesses of the diaphragm without restraint.

When the proximal point of the jejunum is selected, it is picked up with Allis forceps and laid aside for a moment while the line of transection of the stomach is considered.

If at this stage of the operation the stomach is distended with gas and fluid, a tube is introduced into the viscus through a stab wound made in the posterior wall near the vestibule, and suction is applied until the stomach is empty and its walls fall flaccidly together (see fig 26). Before withdrawing the suction tube the small stab wound is surrounded with a purse string suture and tied as the tube is withdrawn.

The stomach should now be firmly drawn well over the left costal margin in an upward and outward direction, thus exposing the upper part of its posterior surface. The line of transection is marked off by fixing a pair of Allis forceps on to the lesser curvature

about 2-2½ inches below the oesophagus to act as a guide, and by clipping another pair high up on the greater curvature in the region prepared for the anastomosis which is close to the lower margin of the gastro splenic omentum

In the *posterior* operation a wide opening is made in the mesocolon through one of the broad avascular areas which exist to the left of the main branch of the middle colic artery, and the proximal jejunal loop is drawn into the supra colic compartment. The left cut margin of the mesocolon is stitched to the posterior surface of the stomach with a series of interrupted sutures about 1 inch proximal to the proposed line of transection, and when the anastomosis is completed the right cut margin of the mesocolon is fixed to the anterior surface of the stomach about ½ inch above the anterior row of sutures, thus placing the stoma in the infra colic compartment of the abdominal cavity

In making the anastomosis, four rows of sutures are used. The first posterior row of interrupted sutures of fine silk is inserted with great care to prevent axial rotation of the intestine and to simplify the introduction of the first posterior continuous suture. Three continuous sutures of No. 0 20 day chromic catgut threaded on curved atraumatic needles are used, the first posterior continuous suture, which starts at the greater curvature, is a right angled seromuscular stitch of the Cushing type and approximates the adjacent margins of the jejunum and stomach. When this reaches the lesser curvature it is locked and laid aside. An incision extending from the lesser to the greater curvature is now made through the seromuscular coats of the stomach down to the mucosa about ¼ inch distal to the first posterior continuous

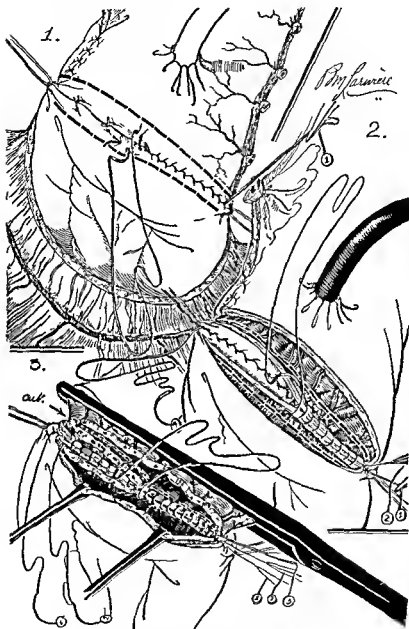


FIG. 27. The Polya operation

The introduction of three posterior continuous sutures is shown.

suture line, and the numerous blood-vessels which are displayed lying on the surface of the mucosa are

individually underrun and tied as they emerge from under the seromuscular flap that lies closest to the lines of suture (fig 27)

This is the surest method of controlling bleeding from the stomach and of keeping the field of operation neat and tidy

The seromuscular coats of the jejunum are likewise incised for a length corresponding to the incision in the posterior wall of the stomach, and any brisk bleeding points are controlled with a fine ligature

The second posterior continuous suture, which is a through and through all coats haemostatic stitch, starts at the greater curvature and finishes at the lesser curvature, where it is locked (fig 27 [2]) The mucous membrane of the jejunum is incised for the full length of the incision, and the interior of the intestine is swabbed and cleansed The mucosa of the stomach is punctured and a stomach tube inserted through the hole to withdraw any remaining gastric secretion, after which the mucosa is divided for the full length of the incision

The third posterior continuous suture approximates the cut edges of the mucous membrane of the stomach and jejunum, and when it reaches the lesser curvature it is likewise locked and laid aside (fig 27 [3]) A large square pack is placed over the gaping mouths of the stomach and intestine, and the stomach is turned over to the right, as it were on a hinge, to expose its anterior surface, where a transverse incision is made with a knife down to the mucosa to permit of easy ligaturing of the numerous vessels which are found here At the lesser and greater curvatures this incision joins the now sutured posterior margins

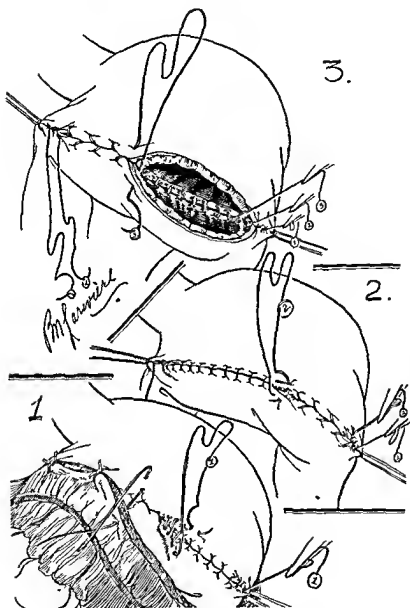


Fig 28 The Polya operation

The anterior rows of sutures are being introduced;
a Schmeiden stitch is shown in diagram 3

The stomach is now put on the stretch and cut
adrift by snipping through the mucosa with scissors.



FIG 29. The Anterior Polya operation completed.

Note the omental reinforcements at the lesser and greater curvatures.

The third posterior continuous stitch is continued as the first anterior continuous stitch and unites the cut

edges of the mucosa of the stomach and jejunum, and when it reaches the greater curvature it is knotted to the point where it started (fig. 28 [3]). Likewise, the second posterior stitch on turning the corner at

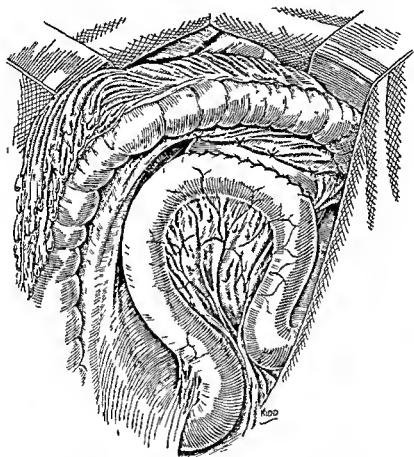


FIG. 30 The Posterior Polya operation completed.

the lesser curvature picks up all the coats of the anterior margin of the stomach and also of the jejunum and proceeds to the greater curvature where it is tied. The third anterior suture finishes as it started, i.e. as an inverting seromuscular Cushing stitch (see fig. 28 [1]).



FIG 31 X ray appearances of a satisfactory Anterior Polya operation

The opaque meal is seen leaving the small funnel shaped gastric pouch and entering the efferent limb of the jejunum which is normal in appearance. There is no evidence of distension of the jejunum, nor is there any jejunitis. The Hoffmeister gastric valve is working efficiently, as no barium can be seen spilling over into the afferent jejunal coil or duodenum. The patient (a doctor) has suffered no abdominal discomfort of any kind since his operation three years ago: his digestion is perfect, he has gained in weight and can now do a full day's work without undue fatigue.

(Dr David Derry)

When the anastomosis is completed, a few interrupted sutures of fine silk are placed here and there on the anterior suture line and especially in the region of the lesser curvature to afford additional security, and also to re-peritonize any raw surface which has been left here (figs 29 and 30)

Should the whole of the cut end of the stomach be utilized in the anastomosis? Where for any reason the stomach is large, it is better to close the top portion, i.e. the side towards the lesser curvature, and make the anastomosis to the lower portion of the cut end of the stomach, for the average case, however, the whole of the cut end of the stomach is implanted into the side of the jejunum. In the *Hoffmeister-Finsterer* type of gastrectomy the upper half is closed, and on completing the anastomosis to the lower half of the stomach the proximal jejunum is stitched to the closed upper part of the stomach, thereby reinforcing the suture line and at the same time interposing a thick valve of gastric and jejunal wall between the outlet of the stomach and the proximal loop of jejunum .

At the completion of this type of operation the jejunum will be seen to be almost vertical with the efferent limb, running downwards in direct continuation with the mouth of the funnel shaped stomach (fig 31)

CHAPTER XIII

MODIFICATIONS OF THE STANDARD POLYA OPERATION FOR SIMPLE ULCER

THERE are a large number of modifications of the standard Polya operation for chronic gastric and chronic duodenal ulcer, but only those of Moynihan, Balfour, Pauchet, of Hoffmeister and Finsterer, and of Bancroft will be described.

In *Moynihan's operation* the mobilization of the stomach and duodenum proceeds as in the standard operation, with the exception that the vascular epiploic arch is not detached intact from the greater curvature. Moynihan preferred to open the lesser sac through the gastro-colic omentum and to divide off the great omentum piece by piece, eventually tying off the right and left gastro-epiploic arteries. After the duodenum has been transected and its distal end invaginated, the left gastric artery is isolated, tied in continuity, and then divided.

Moynihan performed an ante-colic anastomosis, bringing the proximal jejunum across the transverse colon and applying the selected segment of intestine to the cut end of the stomach from left to right, so that the proximal jejunum was first applied to the greater curvature some 4-5 inches from the duodeno-jejunal flexure. He also utilized the whole of the cut end of the stomach for anastomosis with the proximal jejunum and used only two rows of continuous sutures for making the gastro-enteric stoma.

In his hands it was a very safe procedure and he claimed a mortality of only 1.6 per cent. in the treatment of gastric ulcer. His method has been sponsored

by many of his pupils, by Pannett, and by Lahey. Lahey, however, closes the top half of the stomach, i.e. the end towards the lesser curvature, and utilizes the lower half of the cut end of the stomach for the anastomosis with the selected portion of proximal jejunum. In the Lahey modification a longer loop of proximal jejunum is employed, the length of gut stretching from the fixed duodeno jejunal flexure to the lowest portion of the greater curvature being as long as 8 inches or even more. I have made use of this operation on a number of occasions, but I have now abandoned it in favour of the standard Polya operation or of the Hoffmeister-Finsterer method, as post-prandial discomfort is a not uncommon sequel of Moynihan's procedure. Food tends to find its way into the afferent limb of jejunum and thence into the duodenum, where it ferments and gives rise to a considerable degree of flatulence and even of colic.

In the *Balfour operation*, after the stomach has been freely mobilized and is ready for anastomosis with the jejunum, a long loop of proximal jejunum is brought across the transverse colon from right to left, and at the completion of the anastomosis an entero anastomosis is made between the proximal and distal jejunal limbs. The length of proximal jejunum stretching from the duodeno-jejunal flexure to the lesser curvature may be as much as 12-14 inches. The entero-anastomosis is made at the level—or slightly above the level—of the duodeno jejunal flexure to prevent retention of pancreatic juice and bile in the long limb of proximal jejunum. This is a satisfactory operation for gastric ulcer and for cancer of the stomach, but it should *not* be employed in the treatment of chronic duodenal ulcer, as a quantity of the

alkaline juice is shunted away from the gastro-enteric stoma by the small entero anastomosis which is made between the two jejunal limbs

I have on occasion made use of *Pauchet's operation* for gastric ulcers which were situated high up on the lesser curvature and which were in some cases large and penetrating the gastric wall. By this plan the stomach is resected an inch or so below the ulcerated area, and the lesser curvature with the ulcer is then cut away with seissors or a diathermy needle. If the ulcer has deeply pitted the pancreas it may be left behind in the substance of this gland and subsequently cauterized. The lesser curvature is now reconstructed and the attenuated cut end of the stomach is anastomosed to the proximal jejunum, as in the standard operation.

The *Hoffmeister Finsterer* technique is employed by many continental surgeons. The mobilization of the stomach and duodenum is conducted as in the standard Polya operation, a large segment of stomach is removed, and the anastomosis of the proximal jejunum to the cut end of the stomach is made by the retro or the ante colic method. The upper half of the cut end of the stomach—and the stomach is transected obliquely—is then closed, after which the selected portion of the jejunum is anastomosed to the lower half of the cut end of the stomach.

When this operation is finished the inverted upper part of the stomach towards the lesser curvature is further buttressed by suturing the adjacent jejunum over it. In this way a fairly large gastric valve is formed between the gastric pouch and the afferent limb of the jejunum. It is claimed for this method that the valve, as it were, guides the food into the

distal limb of the jejunum and at the same time prevents any nourishment from spilling over into the duodenum, where it is likely to cause flatulent distension (see fig 31)

Pyloric Occlusion combined with Partial Gastric Excision and End-to-Side Gastro-Jejunostomy for Irremovable Duodenal Ulcer

There are many advantages claimed for this operation. It ensures an extensive reduction in acid production and maximum alkali conservation, it preserves the important haematopoietic factor, it is associated with a low mortality, as the duodenum, which may be scarred and fixed, is ignored, and since the ulcer in the duodenum is excluded from the acid gastric chyme healing is assured.

This method, however, ignores a potent factor in the pyloric mucous membrane—a hormone which calls up an after secretion of acid from the principal glands in the body of the stomach. Ogilvie (*Lancet*, 2, 295, 1938) entirely condemns this operation. On analysing his series of cases he found that this method produced a significantly high percentage of anastomotic ulcers and was quick to realize that the chemically induced flow of hydrochloric acid stimulated by an agent arising in the pyloric mucous membrane was more dangerous than the psychic one. This latter, he says, is poured on to food, the former on to an empty stomach.

In cases of irremovable duodenal ulcer excellent results will follow Bancroft's procedure, and more especially Wolfson's and Rothenberg's modification of this method (*Surgery*, 3, 663, 1938). Their technique is as follows. A clamp is applied to the antrum

about 2 inches away from the pyloric outlet, a circular incision is made through the seromuscular coats of the stomach distal to the clamp, and the mucous membrane of the pylorus down to the pyloric canal is stripped free from its muscular tube. In the pyloric canal itself the mucous membrane is very firmly adherent. The cuff of mucous membrane is clamped proximally and distally and cut away. The cut edge of the mucous membrane of the pyloric canal is oversewn and inverted into the pyloric canal, which it plugs, after which the redundant seromuscular sleeve of the pylorus is turned in with a continuous suture and further invaginated and reinforced with a series of interrupted Halsted stitches of fine silk and fatty omentum. The stomach is then widely resected and the operation is completed as by the standard Polya method (fig. 32).

Devine (*Surg., Gynec. and Obst.* 47, 289, 1928) advocated *partial gastric exclusion* for irremovable ulcers of the pyloric segment of the stomach. By his plan the stomach is mobilized and transected in its *upper third*; the wide distal cut end of the stomach is closed, and the proximal cut end is anastomosed to the proximal jejunum. The excluded stomach atrophies and shrinks, and as food cannot enter the excluded pouch the ulcer tends to heal tardily.

It is a highly satisfactory operation for irremovable cancers of the pyloric segment of the stomach. It is also an excellent first stage operation for large simple ulcers of the pylorus, as by the time the second stage is undertaken considerable shrinkage of the ulcer has taken place and the gastric pouch can readily be dissected free and excised with a minimum of disturbance. In the treatment of chronic duodenal ulcer,

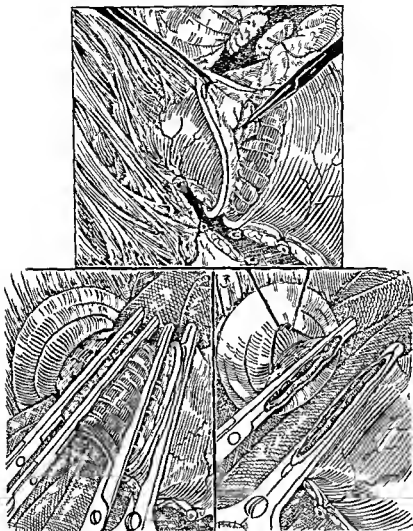


FIG 32 Pyloric occlusion by the Wolfson and Rothenberg modification of Bancroft's procedure

however, it stands condemned, as it leaves behind in the gastric cul de sac all the agents of evil contained in the pyloric mucous membrane

CHAPTER XIV

THE BILLROTH I TYPES OF REPAIR

THERE are at the present time many modifications of the original Billroth I operation. After the stomach and duodenum have been mobilized and the gastroduodenal resection performed, provided the two segments can be readily applied to one another, the surgeon may elect to anastomose the whole of the cut end of the stomach to the cut end of the duodenum (von Harberer's method), he may close the upper half or more of the cut end of the stomach and use the lower half for union with the duodenum, after the technique of W. J. Mayo, Finochietto, &c., he may anastomose the duodenum to the upper half of the cut end of the stomach and close the lower half towards the greater curvature (Horsley's operation), he may implant the whole of the cut end of the gastric pouch into the anterior wall of the second portion of the duodenum (von Harberer Finney operation), or he may perform Schoemaker's operation (fig. 33).

If the diameter of the gastric segment is narrow, then von Harberer's operation is obviously the best and safest procedure to employ, in most cases, however, the cut end of the stomach is about twice as large as the cut end of the duodenum, and in these circumstances it is preferable to close the upper portion of the cut end of the stomach and anastomose its lower end towards the greater curvature with the open end of the duodenum than to employ the von Harberer technique.

I have used the von Harberer Finney operation for cases of duodenal ulcer associated with chronic

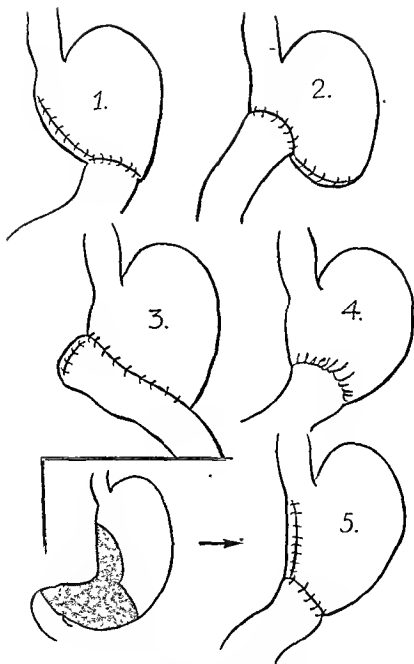


FIG. 33. Billroth I types of repair.

1 Billroth, W. J Mayo, Judin,
Finochietto, &c
2. Horsley.

3. von Harberer Finney.
4. von Harberer.
5. Schoemaker, Morley, Souttar, &c.

duodenal reus, and in order to overcome duodenal stasis a duodeno jejunostomy was carried out at the same time. I have also found the von Harberer Finney operation invaluable in certain cases of anastomotic ulcer following pylorotomy or a niggardly partial gastrectomy for duodenal ulcer.

The technical beauty and the ease of performance of Finochietto's operation have always endeared it to me, and when I am constrained to carry out a Billroth I type of repair I almost invariably choose this one.

I have had no experience of Schoemaker's operation for duodenal ulcer, although I have on occasion employed it for chronic gastric ulcer on the lesser curvature. The *late* results in these cases were not altogether satisfactory.

It should be emphasized that the Billroth I types of operation should not be employed unless the duodenum and stomach are capable of thorough mobilization and unless, following the resection, the upper and lower segments can be brought together without the slightest degree of tension. In my opinion they have a definite if somewhat limited field of usefulness in the surgical treatment of the destructive lesions of the stomach and duodenum.

Technique of the von Harberer Operation

The great omentum is detached from the greater curvature by securing the blood vessels close to the gastric wall, the right and left gastro epiploic arteries are carefully preserved, and after the stomach and duodenum have been mobilized by ligating the right and left gastric arteries and separating the duodenum from its superior, inferior, and posterior attachments,

and also after freeing the second and third parts of the duodenum by Kocher's method, two pairs of small Payr clamps are applied to the duodenum well beyond the ulcerated zone and two further pairs of large Payr clamps are applied to the stomach obliquely in its upper third from the lesser to the greater curvature (fig 34) The stomach is tran-

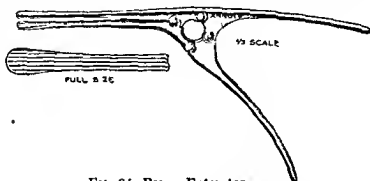


FIG 34 Payr's Enterotome

sected with a cautery between the two gastric clamps, after which the duodenum is similarly divided. The clamp which embraces the end of the gastric pouch is now swung across and brought up against the duodenum, and the gastric and duodenal clamps are rotated laterally to expose the posterior surface of the duodenum and gastric pouch.

The posterior surfaces of the stomach and duodenum about 1 inch proximal to the clamps are now sutured together with a series of interrupted silk sutures, after which a continuous seromuscular suture is inserted above this row of sutures, drawing the seromuscular coats of the stomach and duodenum firmly and evenly together. The clamps are now removed, and, after aspirating any gastric or duodenal contents with a suction tube, the second row of sutures is introduced. This second stitch is a through and

through all coats suture which starts on the greater curvature of the stomach and picks up the duodenal wall at a corresponding point along its inferior border. It passes to and fro, picking up much bigger bites of gastric wall than of duodenal wall, until it reaches the lesser curvature and the superior border of the duodenum, where it is continued anteriorly as a Connel or loop on the mucosa stitch which unites the anterior margins of the stomach and duodenum along the whole line until the suture reaches its starting point where it is tied and cut short. As the cut end of the stomach is usually larger than the cut end of the duodenum, it is always necessary to take larger bites of gastric wall to make up for this disparity.

The suturing is completed by picking up the posterior seromuscular suture and carrying it anteriorly as a Cushing stitch, after which a further series of closely applied interrupted Halsted sutures of fine silk are inserted all around the line of anastomosis.

Finochetto's Method

After the stomach and duodenum have been freely mobilized—and Finochetto attaches great importance to the liberal freeing of the first, second, and third portions of the duodenum—the first part of the duodenum is transected between enterotomes. One clamp of a pair of Lane's straight gastro-enterostomy forceps is applied to the duodenum about 1 inch beyond the enterotome. On the line selected for the gastric resection a large Payr clamp is crushed home, and about 1 inch proximal to this the other clamp of the Lane forceps is affixed (fig. 35).

A seromuscular cuff of stomach wall is next fashioned by cutting through these two layers close to

the large Payr clamp and by dissecting them upwards for a distance of $\frac{1}{2}$ inch from the underlying mucosa. The blood vessels lying on the exposed anterior and posterior surfaces of the mucosal sleeve are underrun and ligatured one by one before cutting the stomach adrift. The exposed mucous surface of the stomach

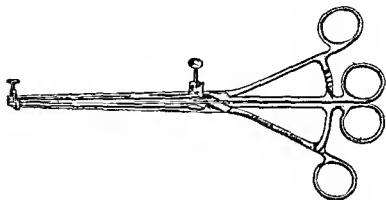


FIG. 35 Lane's straight Gastro Enterostomy forceps

is then thoroughly cleansed, the segments of stomach and duodenum, which are now prepared for anastomosis, are laid side by side, and the enterostomy blades are locked, after which the lower half or so of the posterior seromuscular flap of stomach wall is sutured to the posterior wall of the duodenum about $\frac{1}{3}$ inch above the enterostomy clamp which steadies the duodenum (fig. 36 [1])

When this stitch, which starts at the greater curvature and finishes at the superior border of the duodenum, is inserted, it is tied and cut short fig. 36 [1]. The duodenal enterotome is now removed and the crushed duodenal portion is trimmed away and the gut swabbed dry. The master stitch is now inserted. It is a long suture of No. 0 20 day chromic catgut mounted on a fairly long straight atraumatic needle.

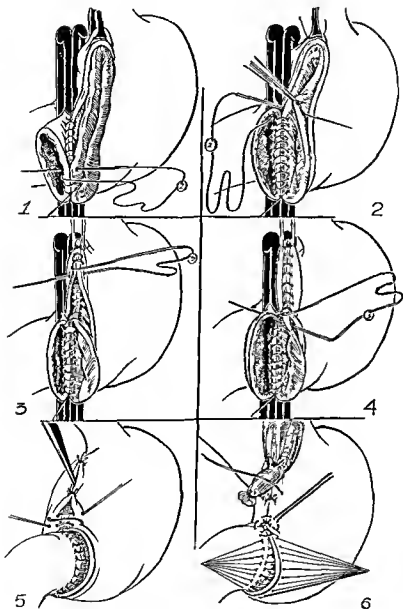


FIG 36 Tinochetto's method of performing the Billroth I type of repair

The suture starts at the greater curvature of the stomach by picking up the mucous membrane here

and then passing across to a corresponding point in the duodenum where it pierces all the coats of the posterior margin of the intestine. This suture proceeds upwards, catching only the gastric mucosa posteriorly, but the whole thickness of the duodenal wall on the opposing side (fig 36 [1]). When this stitch reaches the upper border of the duodenum, it is locked once or twice before it transfixes both edges of the gastric mucous membrane at this point (fig 36 [2]). The mucosal suture thus commenced continues in an uninterrupted fashion, drawing together the anterior and posterior margins of the mucous membrane of the stomach until it reaches the lesser curvature. Here the needle is made to transfix the seromuscular coat of the lesser curvature and is then continued downwards, drawing together the seromuscular margins of the anterior and posterior walls of the stomach (fig 36 [3]). When the upper border of the duodenum is reached the needle picks up the anterior edge of the gastric mucous membrane and anchors it to the whole of the anterior cut margin of the duodenum, and when it reaches the greater curvature it is tied and cut short (fig 36 [4 and 5]).

The gastro enterostomy clamps are now removed and a series of cross stitches of fine silk or of No 0 20 day chromic catgut draw together the anterior seromuscular coats of the stomach and anterior duodenal wall and thus conceal and further protect the first anterior row of continuous sutures (fig 36 [6]). Three or four cross stitches are likewise introduced at the lesser curvature to enfold even further the margins of the stomach in this position, and the operation is completed by passing a purse string

suture at the critical point, i.e. where the enfolded lesser curvature meets the superior border of the duodenum (fig 36 [6])

W. J. Mayo's Method

In this operation the vascular epiploic arch is detached from the greater curvature and the blood-supply to the great omentum is preserved. The right and left gastric arteries are doubly ligated and divided, and the stomach is freely mobilized. Two large Payr clamps are then applied obliquely to the upper third of the stomach, the tips of the blades being about 2 inches distant from the cardiac orifice, and the joints about 1 inch or so distal to the lower margin of the gastro splenic omentum. The stomach is divided with a cautery between these two Payr clamps and the distal end of the stomach is wrapped in a large swab and laid over the right side of the chest, while the proximal Payr clamp is elevated to facilitate the closure of the upper half of the cut end of the stomach. The upper half of the gastric pouch embraced by the Payr clamp is then oversewn with a running suture, and after an enterostomy clamp has been applied across the pouch about 2 inches proximal to the clamp, the Payr clamp is removed and the suturing is continued. The needle is picked up after the suture has been drawn taut, and the suture line is invaginated with a continuous Lembert stitch. The suture line is now further invaginated with a series of Halsted stitches. The lower half of the cut end of the stomach towards the greater curvature is trimmed to the approximate calibre of the duodenum, its contents are aspirated, and the small cavity thoroughly cleansed.

The small gastric pouch, which is steadied with an enterostomy clamp, is now covered with a large warm swab while the first and second portions of the duodenum are being liberated. The pancreatico-duodenal artery is ligatured and the many fine adhesions which exist between the posterior surface of the first portion of the duodenum and the head of the pancreas are isolated, tied in two places, and divided. After the distal gastric pouch has been firmly rotated outwards and to the right, these adhesions, which often contain sizable blood-vessels, are put on the stretch to simplify the process of their dissection.

When the first and second portions of the duodenum have been fully mobilized, the parts will be ready for anastomosis. The proximal gastric pouch, which has been prepared for anastomosis, is drawn across and its lower open end is applied to the posterior aspect of the mobilized duodenum. Using the distal gastric segment as a tractor simplifies the suturing, as the duodenum can be freely manipulated into the desired position. The posterior wall of the duodenum is affixed to the posterior wall of the stomach with a series of interrupted sutures and a continuous seromuscular stitch. The posterior wall of the duodenum just above the suture line is divided from its superior to its inferior border, and, still using the distal segment as a tractor, the second continuous posterior suture is introduced. This suture starts at the upper end of the duodenum and unites the posterior cut margin of the duodenum to the posterior margin of the gastric opening. When it reaches the greater curvature, the anterior wall of the duodenum is cut through with scissors and the gastro-duodenal segment is removed.

The parts now resemble a gastro jejunostomy after the posterior sutures have been inserted. All that remains to be done is to continue the posterior through and through all coats suture anteriorly as a Connel stitch which draws together the anterior margins of the stomach and the duodenum. The first posterior seromuscular continuous suture is again picked up and continued anteriorly as a Lembert suture which invaginates the Connel stitch. At the critical angle, i. e. at the point where the lesser curvature meets the superior border of the duodenum, a purse string suture is inserted as a safeguard, the suture line is inspected, and at any weak spot a Halsted stitch is applied for added security and to give a neat finish to the operation.

Horsley's Method

In the modification described by Horsley, after the gastro duodenal segment has been removed between enterotomes, the lower half of the cut end of the stomach towards the greater curvature is closed and the open portion towards the lesser curvature is anastomosed to the cut end of the duodenum. The essential steps of this operation are illustrated in fig. 37.

I have found this operation more difficult to carry out than any of those which have already been described. It has always seemed to me that there is more stress upon the suture line when the anastomosis is made at the lesser curvature than when it is made at the greater curvature. Horsley considered that it was important to make full use of the remaining portion of the lesser curvature, as this is the part more actively concerned in peristaltic movement.

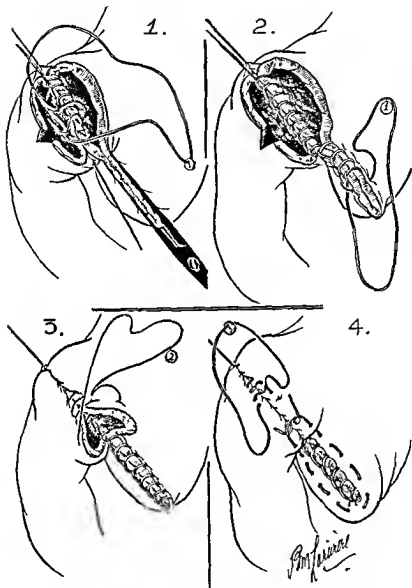


FIG. 37. Horsley's method of performing the Billroth I operation.

The von Harberer-Finney Method

This operation was described independently by von Harberer and by Finney. By their plan the first part of the duodenum, the pyloric segment, and a variable amount of the body of the stomach are removed. The

duodenal stump is closed and well invaginated, after which the whole of the cut end of the stomach is anastomosed to the anterior aspect of the second part of the mobilized duodenum

The danger of axial rotation or flattening of the second portion of the duodenum against the spinal column or of kinking of the commencement of the third portion of the duodenum can be surmounted by thorough mobilization of the duodenum by Kocher's method

Schoemaker's Operation

Here the first inch or so of the duodenum, the pyloric segment, and the greater portion of the lesser curvature, including a generous margin of the anterior and posterior walls of the stomach, are excised in one piece, after which with the aid of special clamps, such as those designed by Schoemaker, Morley, or Souttar, the lesser curvature is reconstructed and the open end of the stomach is anastomosed to the cut end of the duodenum by the end to end method

This operation is, so far as I can gather, rarely employed in Great Britain for chronic duodenal ulcer, although it has a field of usefulness in the management of small or moderate sized gastric ulcers on the lesser curvature. Morley, for instance, performed this operation for ulcer of the body of the stomach in 119 cases with 3 deaths, a mortality of 2.5 per cent. In his hands, when applied to cases of gastric ulcer, it is a safe operation yielding good clinical results

CHAPTER XV

SUB-TOTAL GASTRECTOMY FOR CANCER OF THE STOMACH

CARCINOMA of the stomach is the commonest of all malignant growths, and its treatment by operative measures has a high death rate and a low cure rate. The mortality of sub total gastrectomy for gastric cancer is, in the best hands, about 20-30 per cent. Ogilvie (*Surg, Gynec and Obst* 68, 295, 1939) states that the present cure rate, judged on the 5 year standard, is from 5 to 10 per cent of all cases operated upon. If the inquiry is limited to cases suitable for sub total gastrectomy the cures increase from 15 to 17 per cent and if only the patients having had sub total gastrectomies and leaving hospital are considered, the rate rises to 20-25 per cent. He gives the table overleaf.

Success in the treatment of cancer of the stomach depends almost wholly upon early diagnosis, upon early operation and upon extending even further the scope of the radical operation. Early diagnosis not only increases the operability rate, the resection rate, and the cure rate, but also considerably lowers the operative death rate (figs 38 and 39).

Pre-Operative Treatment

The patient should be admitted to hospital about a week before operation and treated on the following lines

1 *Special Diet* A non residue diet with a full quota of sugars, fats, and vitamins, which would include malt and cod liver oil, sweetened lemon or lime juice, and fresh cream, is essential. The patient

The fate of 200 cases of cancer of the stomach presenting themselves at hospital for treatment

TABLE II

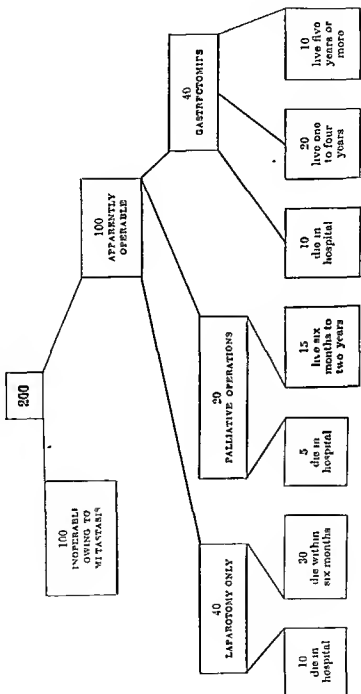




FIG. 38 Skiagram showing an advanced Carcinoma of the pyloric segment of the stomach

At operation the growth proved to be irremovable

(Dr Cecil Bull)

should be encouraged to drink sweetened water in large quantities. If he is drinking 5 pints in the 24 hours he is doing moderately well, if he can take 10 pints he is doing even better.

If there is any gastric retention or if vomiting is a troublesome feature, fluids only are prescribed.

2. *Gastric Lavage and Medicines.* The stomach is



FIG 39 Carcinoma of the stomach showing typical 'finger print' deformity of the lesser curvature (Dr. Cecil Bull)

aspirated and then irrigated with normal saline solution once or twice a day according to the amount of gastric retention present. In every case aspiration is carried out about 2 hours before operation is commenced. Before the stomach tube is removed about 20 c c. of 0.25 per cent. hydrochloric acid solution is

run into the stomach to disinfect its mucous surface, and this fluid is not removed. I have adopted Horsley's method of giving the patient a weak hydrochloric acid mixture for 3 or 4 days before operation, as this is probably the most efficient method of reducing the bacterial content of the stomach. Pain is diminished by giving nepenthe, 20 mm in 1 drachm of milk 3 times a day, while small doses of morphia may in addition be indicated.

3 *Intravenous Infusions* If the patient is anaemic, blood transfusions are given until the haemoglobin content is raised above 75 per cent, but even in those patients who are in no apparent need of blood a small transfusion of whole blood is given shortly before operation. In patients who are debilitated and dehydrated it is a wise measure to order intravenous infusions of glucose saline in addition to the blood. In all poor-risk patients the slow drip of blood and glucose saline is continued during the operation and for the first day or two, or perhaps even longer, after operation.

4 *Pre-Medication* Omnopon, $\frac{1}{3}$ gr., is injected about 1 hour before the operation is due to commence, and a further $\frac{1}{3}$ gr. is given when the patient arrives in the operating theatre.

Local Anaesthesia

In a number of cases the operation can be satisfactorily conducted under local anaesthesia. The usual solution employed is 0.5 per cent novocain solution to which no adrenaline is added. In all, some 500 c.c. will be required for the regional block, for the splanchnic block, for the mesenteric block, and for the infiltration of the parietal peritoneum. As one

becomes more expert in the use of local anaesthesia for gastric surgery, the amount of solution required decreases. For my first cases I used as much as 800 c c. without any ill-effect, but now I have been able to reduce this to 500 c c or even less—300 to 400 c c.

When the patient is placed on the operating table his ears are plugged with cotton-wool, his eyes are bandaged, and his arms are strapped to the sides of the table. The abdomen is prepared in the usual way, the abdominal sheets are placed in position, and five weals are raised for the rectus sheath block. Using a very fine hypodermic needle fixed to a small Record syringe, one intradermal weal is placed exactly over the lowest point of the xiphisternum, and two each side of the outer border of the rectus muscles in their subcostal and interspinous planes. A larger and longer needle is used for the subcutaneous and sub-aponeurotic injections. The needle is inserted through the right lateral weals, and about 50 c c of anaesthetic solution is run into the subcutaneous tissues along the outer border of the rectus muscle. A similar injection is then made on the opposite side, using the same amount of anaesthetic solution. Through the top rectus weals the subcutaneous tissues just below the costal margins are freely injected, after which, using the xiphisternal weal, the area over the lower part of the sternum and that on the right and left sides over the ribs also receive a subcutaneous injection. Using the same weal, the flat fleshy bellies of the rectus muscles close to the costal margins are infiltrated, after which the aponeurotic sheath of the rectus muscles at their lateral borders is liberally injected to block the nerves as they course inwards.

After an interval of 5 minutes the abdomen is opened through a vertical midline epigastric incision, and the edges of the peritoneum are picked up and retracted upwards to enable the surgeon to place a pool of anaesthetic solution into the loose extra-peritoneal tissues of the anterior abdominal wall. This is done by plunging the needle through the parietal peritoneum until it lies in the space between the muscle



FIG. 40. Deaver retractor.

and the superior surface of the peritoneum. As much of this space as is accessible should receive some of the anaesthetic solution.

The splanchnic block is now carried out by placing a Deaver retractor beneath the liver and hooking it upwards, by drawing the stomach downwards, by placing the index finger of the left hand on the first lumbar vertebra between the aorta and the inferior vena cava, and by slipping the point of a long needle into the space thus cleared by the finger and injecting from 50 to 70 c.c. of the novocain solution (figs. 40 and 41).

When the needle is in place it is a wise precaution to aspirate before injecting the solution in order to make quite sure that the point of the needle has not punctured and entered a blood-vessel. Some 10 c.c. of the novocain solution is then injected into the gastro-hepatic omentum close to the lesser curvature high

up to block the vagus nerves, 10 c c is run into the suspensory ligaments just above the pylorus, and a further 10 c c is injected into the loose tissues beneath the first portion of the duodenum. The mesenteric injection is completed by infiltrating the base of the mesocolon with a further 10 c c of the anæsthetic solution.

This completes the introduction of the local anaesthetic, which should be effective for an average of about 2 hours. It is, however, necessary at the completion of the sub total gastrectomy to infiltrate the parietal peritoneum for a few inches on both sides of the wound before closing the incision.

Choice of Operation

If the stomach is deemed to be resectable, there is of course a choice of many operations. Total gastrectomy is only indicated for cases of operable leather bottle stomach and for those exceptional cases of multiple leiomyosarcomata of the

stomach and of extensive gastric polyposis in which there are grounds for believing that the

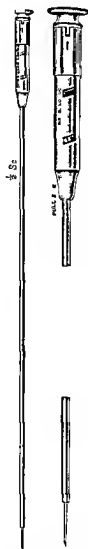


FIG 41 Special needles used for Braun's splanchnic block.

polypoid masses have undergone cancerous degeneration

In the average case the best procedure is a radical Polya operation, although in a few instances a Billroth I repair is to be preferred. It is preferable, for instance, for cases in which the patient is old and infirm, where the growth is small and limited to the pyloric segment, and glandular involvement is sparse. The Billroth I is quicker and less shock producing than the Polya types of anastomosis, again, as the operation is confined to the supra colic compartment and contamination is reduced to a minimum, it has something to recommend it provided the surgeon is skilled in this method of repair.

Technique of Radical Sub-total Gastrectomy

The operation is commenced by withdrawing the transverse colon, by steadying it, lifting up the great omentum, and putting it on the stretch so that it can, with a few strokes of the knife, be detached from the large bowel. The whole of the great omentum is stripped away from the transverse colon and the omental vessels together with the posterior peritoneum of the lesser sac are stripped upwards until the ridge of the pancreas is reached (fig 42). The pyloric end of the stomach is elevated and the peritoneum over the head of the pancreas is stripped free, exposing the gastro duodenal artery as it lies in its groove in the pancreatic substance. The artery is isolated, tied in two places and divided, and the pancreatico duodenal branch which it gives off is likewise dissected free, picked up, tied, and divided (fig 43). The right gastric artery is underrun, clipped in two places, divided, and ligatured with

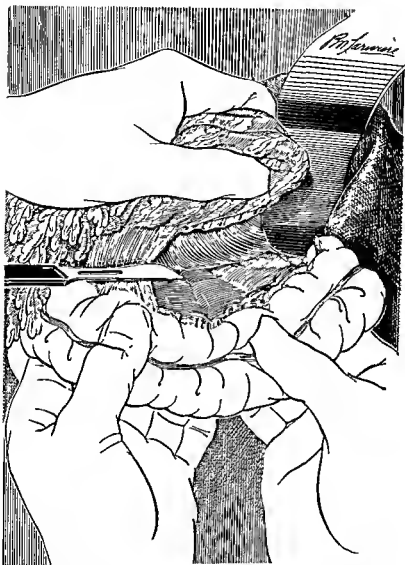


FIG. 42. Sub-total Gastrectomy for Carcinoma of the stomach.

The great omentum is stripped away from the transverse colon.

strong silk, after which the gastro-hepatic omentum is snipped through with scissors close to the liver until the main vascular pedicle, i.e. the left gastric artery, is reached.

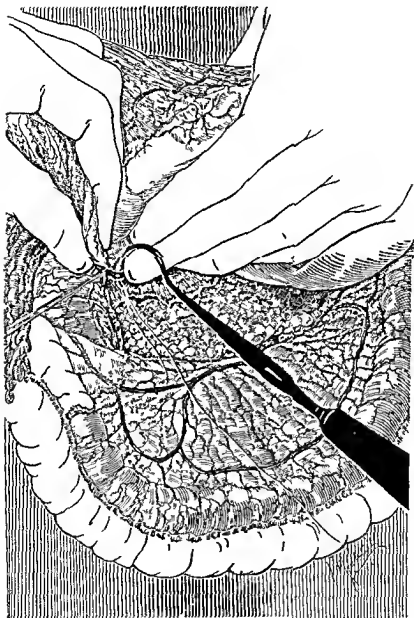


FIG 43 Sub total Gastrectomy for Carcinoma of the stomach
The gastro duodenal artery is being ligated at the upper border of the
pancreas

The next step consists in thoroughly mobilizing the first portion of the duodenum and dividing it between clamps fully $1\frac{1}{2}$ inches away from the pyloric outlet. The distal end of the duodenum is then oversewn and closed and is further invaginated with a purse string suture of silk (see fig. 25).

The stomach is now drawn downwards and over to the left to put the left gastric artery on the stretch, the peritoneum over the artery is cautiously incised and stripped downwards in order to expose the main branch of this important vessel and to allow two ligatures to be passed with an aneurysm needle close to its origin and tied (fig. 44). The artery is divided between ligatures, the accompanying vein is isolated and likewise ligatured and divided, after which the fatty mass with its glands is stripped downwards with the fingers along the lesser curvature for a distance of 2-3 inches. This dissection leaves a raw space on the lesser curvature, stretching from the oesophageal opening downwards along the lesser curvature for a few inches. This raw area should be reperitonized at once with a series of interrupted sutures.

The greater curvature is next further mobilized by underrunning the left gastro epiploic artery and by dividing it, by freeing the lower portion of the gastro splenic omentum, and by separating any fibrous bands or adhesions which bind the posterior aspect of the stomach to the peritoneum of the lesser sac. The stomach should now be free and quite mobile and is ready for anastomosis with the jejunum.

The stomach is again drawn firmly downwards and then rotated over the left costal margin to expose the full face of its posterior wall. It is held and steadied in this position by an assistant. The transverse colon is



FIG 44. Sub total Gastrectomy for Carcinoma of the stomach.
The left gastric artery is being secured close to its origin from the coeliac
axis

crowded into the space which was formerly occupied by the stomach, and any redundant loop is tucked

underneath the right lobe of the liver The duodeno-jejunal flexure is identified and the first loop of jejunum is picked up and drawn through the wound. A fairly long loop should be chosen, and the point selected for anastomosis with the stomach should be about 8-12 inches from the duodeno jejunal flexure The selected segment is applied to the under surface of the stomach so that its proximal point lies at the lesser curvature and its distal point at the greater curvature The segment of intestine which is to be anastomosed to the stomach is steadied with Allis forceps at each end The jejunum is now anchored to the under surface of the stomach along an oblique line which stretches from a point on the lesser curvature 1 inch from the cardiac orifice, downwards to a point on the greater curvature, on a level with the lowest portion of the gastro splenic omentum that has just been freed, using a series of interrupted sutures of fine silk.

The first posterior continuous seromuscular suture is of fine silk and is introduced, drawing together the contiguous margins of the stomach and jejunum; this suture commences at the greater curvature and finishes at the lesser curvature, where it is locked The seromuscular coats of the posterior wall of the stomach are now incised down to the mucous membrane along a line parallel with and one-third of an inch above the first row of sutures. The blood-vessels lying on the mucous coat are individually underrun and tied off, and when this is completed the whole stomach is turned over to the right and the seromuscular incision is continued anteriorly from the lesser curvature to the greater curvature. The blood-vessels lying on the anterior sheet of mucous



FIG 45 Sub total Gastrectomy for Carcinoma of the stomach
An ante-colic anastomosis is being performed

membrane are likewise underrun and tied off (fig 45)

The mucous membrane at the lesser curvature is now divided with scissors, and using the stomach as a tractor the upper half of the cut end of the gastric pouch is closed with two rows of sutures, the first closing the margins of the mucosa and the second bringing together the seromuscular edges of the anterior and posterior walls (fig 46)

This suture line is further invaginated with a series of interrupted silk sutures. When the upper half of the cut end of the gastric pouch has been securely closed and inturned in the manner described, the transection is completed and the large gastric segment is removed. The opening that is now made in the portion of jejunum which is anchored to the small gastric pouch should correspond in length and in size with the lower half of the open end of the stomach. Two rows of continuous sutures of fine silk are used for fashioning the gastro enteric stoma.

The operation is completed by picking up the first posterior continuous suture and carrying it anteriorly from lesser to greater curvature as a Cushing right angled stitch, and the suture line may be further reinforced by a series of interrupted sutures (see fig 46)

In this radical sub total gastrectomy approximately four fifths of the stomach, 1 inch or more of the first portion of the duodenum, the whole of the great omentum, the gastro hepatic omentum, and all the nodes along the greater and lesser curvatures of the stomach, in addition to those which are clustered around the antrum and pylorus, are removed in one block.

No clamps are used in this operation as they are cumbersome and tend to limit the size of the segment

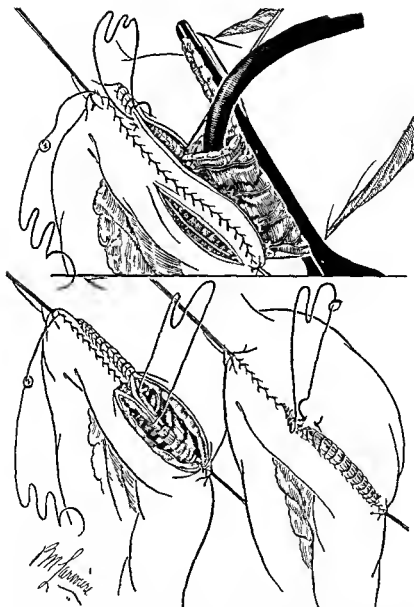


FIG 46 Sub total Gastrectomy for Carcinoma of the stomach
The method of fashioning the gastro-enteric stoma and gastric valve is depicted

of stomach removed, which must necessarily be as large as possible.

The upper half of the cut end of the stomach is closed because following a fairly high gastric resection it is difficult to anastomose this inaccessible part to the selected segment of jejunum.

CHAPTER XVI

TOTAL GASTRECTOMY

IN the operation of total gastrectomy the whole stomach, including a fringe of oesophagus and the proximal inch of the first part of the duodenum, the whole of the great omentum, and portions of the gastro splenic omentum and gastro hepatic omentum are removed in one piece, after which the cut end of the oesophagus is anastomosed to the cut end of the duodenum (oesophago duodenostomy) or the cut end of the oesophagus is anastomosed to a segment of proximal jejunum (oesophago jejunostomy)

It is important to distinguish total gastrectomy from sub total gastrectomy. If any portion of the stomach close to the cardia or pylorus is involved in the anastomosis, this at once places the operation in the category of sub total resections.

The first total gastrectomy was performed by Connor in 1883 (*Medical News*, 45, 578, 1884). His patient died a few hours after the operation. The first successful case of total resection of the stomach was described by Schlatter (*Chir* 19, 757, 1897). This case survived the operation for some months, eventually dying of secondary deposits in the liver. Considerable interest was aroused in the technique and the potentialities of this operation following Moynihan's description (*Lancet*, 2, 1748, 1907) of a successful total resection of the stomach followed by oesophago jejunostomy for a case of leather bottle stomach. Moynihan's vivid description of the operation he performed upon this man and of his subsequent progress is given in some detail in his book, *A dominal Opera*

tions. His patient eventually died of pernicious anaemia. Finney and Reinhoff (*Arch Surg* 18, 140, 1929) tabulated 67 cases in which there was a mortality of 53·8 per cent. Roeder (*Ann Surg* 98, 221, 1938) recorded 91 cases of which 44 died—a mortality of nearly 50 per cent. Lahey (*Surg, Gynec and Obst.* 67, 213, 1938) gave a description of 8 cases which were operated upon in his clinic at Boston. In a recent contribution (*Surg Clin N. Amer* 20, 611, 1940) he records 27 total gastrectomies with but 7 fatalities. There are now a large number of cases available for the statistician, and a review would show that approximately half the cases operated upon die as the result of this major procedure, that few of the patients survive for more than 18 months, and that none of them have lived for longer than 5 years. The records of cases in British literature are scanty, but Joll has performed 12 total gastrectomies, Dickson Wright 11, Walton 8, and Gordon-Taylor 6. In a personal series of 6 cases 4 died as a result of the operation and 2 survived for a period of only approximately 10 months.

Indications for Total Gastrectomy

- 1 In cases of localized and of diffuse leather-bottle stomach in which the intra abdominal portion of the oesophagus is not involved in growth. In the diffuse type the operation should not be carried out if the stomach is adherent to the pancreas, if there are secondary deposits in the liver, or if there is wide extension of the growth to adjacent omenta.
- 2 In multiple leiomyosarcomata of the stomach.
- 3 In certain cases of diffuse polyposis of the

stomach (a very rare disease) in which haemorrhage threatens life or the possibility of malignant degeneration is present.

The operation is *never* justifiable for chronic gastric ulcer, nor should it be performed for the more localized growths of the body or fundus of the stomach for which a sub total resection would suffice.

Technique of Total Gastrectomy

The anaesthetic of choice is a high spinal, employing percaine by the Howard Jones technique. A long left paramedian incision should be chosen in preference to Marwedel's incision with reflection of the lower costal margin.

The first step in the operation consists in freeing the stomach from its vascular attachments. The great omentum is stripped away from the transverse colon, the gastro duodenal artery is tied in two places and divided beneath the pylorus, and the right gastric artery is underrun, ligatured off, and divided, after which the duodenum is mobilized, clamped with enterotomes 1 inch or so from the pyloric outlet, and the bowel divided between these clamps. The distal end of the duodenum is infolded and further invaginated with a purse-string suture. When this step is completed the gastro hepatic omentum is snipped through, the left gastric artery is isolated close to its origin, doubly ligated and divided, and the mobilization of the stomach is completed by securing the left gastro epiploic artery and cautiously cutting through the gastro-splenic omentum, after all the blood-vessels in this structure have been carefully picked up and ligatured.

I do not consider it advisable to remove the spleen

in cases of total gastrectomy If the gastro splenic omentum is carefully detached from the greater curvature of the stomach, it is possible to mobilize the organ without damage to the main vascular pedicle of the spleen

The stomach is now wrapped in gauze and firmly drawn downwards to render the peritoneum over the oesophagus taut The peritoneum in this region, which is reflected from the diaphragm over the anterior surface of the oesophagus, is then cut in a U-shaped flap, after which this flap is dissected free from the oesophagus by gauze dissection Firm traction should then be made on the stomach, drawing it forcibly upwards towards the left shoulder to display the posterior aspect of the oesophagus, which is then freed by blunt dissection to permit of a further mobilization At this stage the lower end of the oesophagus will be bared, and it should be possible to draw down at least 1 inch or more of the intrathoracic portion after this dissection has been completed

A portion of the jejunum some 12-16 inches from the duodeno jejunal flexure is selected for the anastomosis and is brought in front of the transverse colon and laid against the under surface of the oesophagus, which is now well displayed by an assistant who exerts steady upward traction on the stomach The jejunum is sutured to the posterior wall of the oesophagus with a series of interrupted Halsted sutures of fine silk mounted on an atraumatic needle (fig 47) At the right and left extremities of the suture line two of these sutures are left long to act as guides and tractors In front of these interrupted sutures a small opening is made into the oesophagus at the extreme

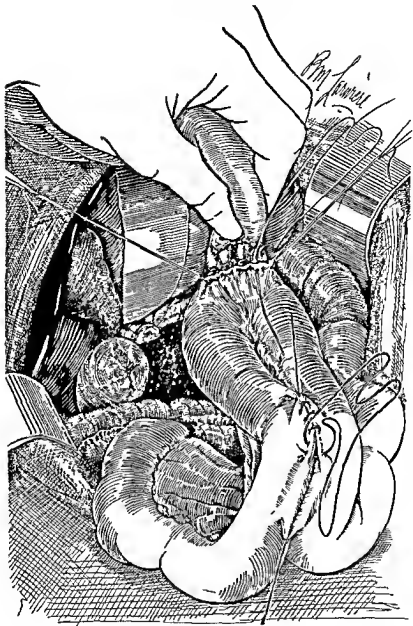


FIG 47. Total Gastrectomy.

A loop of proximal jejunum is being anastomosed to the oesophagus. The operation is completed by performing an entero anastomosis between the afferent and efferent limbs of the jejunum.

left end of its attachment, and a suction tube is introduced into the oesophagus and then into the stomach to remove any contained secretions. A small opening is made through all the coats of the jejunum, $\frac{1}{4}$ inch below the interrupted sutures, and a posterior continuous lockstitch suture is introduced.

These openings in the oesophagus and jejunum are enlarged little by little from left to right, and as they are enlarged their cut edges are evenly sutured together. This sequence of a small incision, the insertion of a few stitches, slight enlargement of the incision, and a few more stitches is continued until the whole of the posterior wall of the oesophagus has been divided and sutured to the adjacent margin of the jejunum. Around the anterior wall of the oesophagus the same sequence is continued the stitch now being changed to a Connel type or to the ordinary through and through all coats haemostatic suture. The stomach therefore is used as a tractor, drawing down the oesophagus until the last piece is severed. At this juncture the line of anastomosis is completed, whereupon the anterior suture line is further reinforced and invaginated with a series of interrupted mattress sutures of fine silk. A few anchor sutures are inserted fixing the jejunum to the diaphragm on either side of the anastomosis to prevent the oesophagus from withdrawing upwards into the thoracic cavity.

The small posterior flap of diaphragmatic peritoneum which was fashioned when the oesophagus was being freed posteriorly is stitched to the posterior wall of the jejunum with three or four interrupted sutures, and when this is completed the anterior flap of diaphragmatic peritoneum is sutured to the anterior

wall of the jejunum below the anastomosis to relieve the suture line from any tension

Great importance is attached to relieving as far as possible any strain on the suture line owing to the fact that the oesophagus is very thin and friable and leakage at the suture line is prone to occur

The operation is completed by making a small entero anastomosis between the proximal and distal limbs of the jejunum about 3 inches above the duodeno jejunal flexure. This is done with the object of diverting the bile and pancreatic juices away from the anastomosis, and also to prevent the dumping of food into the proximal limb of the jejunum

Before the abdominal incision is closed a Ryle stomach tube is passed through the nose down the oesophagus and then led into the efferent limb of the jejunum and well beyond the entero anastomosis. This tube is used for feeding purposes during the first three or four post operative days. It helps to relieve any strain on the suture line and at the same time makes the added operation of jejunostomy a superfluous procedure

The anastomosis of the cut end of the oesophagus to the cut end of the duodenum is not recommended as it has a higher mortality than oesophago jejunostomy, and however carefully or however thoroughly the duodenum is mobilized it is impossible to unite it to the cut end of the oesophagus without a certain degree of tension

It is advisable to give these patients ferrous salts, liver extract, and a mixture of dilute hydrochloric acid daily for several months to ward off the possibility of the later development of macrocytic anaemia

CHAPTER XVII

THE SURGICAL TREATMENT OF IRREMOVABLE NEOPLASMS OF THE STOMACH

THE surgeon should make it a rule that in cases of cancer of the stomach exploratory coeliotomy should be carried out unless recognizable irremovable metastatic deposits can be demonstrated

Provided no metastases are found on examination, the patient should be given the benefit of the doubt, even although the disease may appear to be advanced

The operability of the case cannot be judged solely by the size of the tumour. With large movable tumours where sub total gastrectomy is found possible, the late results are frequently good. The massive proliferative growths of the body of the stomach and of the greater curvature, which so often produce large epigastric tumours, metastasize late in the course of the disease, are locally malignant for a considerable period, and frequently lend themselves to partial gastric excision

Radiological investigation is of course indispensable in the diagnosis of neoplasms of the stomach, and in determining operability considerable help will also be afforded by gastroscopy and peritoneoscopy. The most instructive article to date dealing with every aspect of peritoneoscopy is given by Ruddock (*Surg, Gynec and Obst* 65, 623 1937). In border line cases the surgeon should not be unduly influenced by the radiologist's report that the growth is extensive and unquestionably fixed to neighbouring structures, since widely infiltrating cancers (linitis plastica) or even multiple neoplasms (leiomyosarcomata) of the

gastric wall are sometimes resectable, and fixation of itself does not necessarily denote that surgery is contra-indicated. In these difficult cases the surgeon is advised to be guided by the clinical findings.

Clinical Signs of Inoperability

The case should be considered inoperable if:

1. The liver is enlarged and nodular from secondary implants.
2. Ascites is present.
3. Hard plaques of secondary growth are felt *per vaginam* or *per rectum* in the pelvic peritoneum.
4. Virchow's gland in the neck is stony hard, enlarged, and fixed to surrounding structures.
5. Nodules of growth are present at the umbilicus.
6. Subcutaneous nodules of growth can be detected.

Exploratory Coeliotomy to determine Operability

There should be a methodical examination of the stomach, the duodenum, the omenta and mesenteries, the lesser sac, the liver, and the pelvic shelf.

The size, the shape, and the position of the stomach often have an important bearing upon prognosis. The long J-shaped ptosed stomach which is so frequently the seat of carcinoma of the pylorus or of the pars media is often mobile and lends itself readily to resection, whereas the small steerhorn stomach which is so frequently involved by rapidly infiltrating ulcerative growths is commonly tucked beneath the diaphragm and liver, and being small and contracted frequently proves difficult to mobilize and to excise at a sufficiently high level.

The extent and the position of the growth will

often influence the type of resection that is to be performed. For instance, in leather-bottle stomach the best procedure is a total gastrectomy. For removable tumours of the cardia it has been possible to carry out resection of the lower few inches of the oesophagus together with a portion of the body of the stomach, and to perform an intra-pleural anastomosis of the cut end of the oesophagus with the cut end of the stomach, thereby restoring the ability to swallow. Again, certain localized malignant polypoid tumours of the fundus may demand little more than a *wide V*-excision of this portion of gastric wall. Extensive invasion of the gastric wall does not therefore necessarily imply that a wide excision is impossible, although with growths of the body, and particularly of the lesser curvature, upward extension to the cardia contra-indicates sub-total gastrectomy.

It is commonly taught that tumours of the pylorus as they give rise to considerable gastric disturbance at an early stage are more likely to be operable than those growths which occupy the body of the stomach. This, however, is not the case. Pyloric growths are often fixed to the underlying pancreas and involve the regional lymph nodes with metastatic implants at an early stage of the disease, whereas growths of the body are of more leisurely spread, glandular involvement is tardy, and fixation is a comparatively late event.

In all cases the lesser curvature should be palpated with the greatest care. The surgeon should not mistake oedema, fibrosis, or muscular hypertrophy of the lesser curvature for involvement with growth.

Ulcers on the greater curvature, although rare, are

usually malignant in character, and the bulky cancers which occur here are generally of the malignant polypoid group. They offer an excellent prognosis following a wide gastric excision.

It is well to remember that fixation does not of itself spell inoperability, as the stomach may be bound to the lesser sac by congenital or inflammatory adhesions; but as a rule cohesion of a malignant stomach to the liver, to the pancreas, to the lower reaches of the duodenum, to the mesocolon, or to the root of the mesentery precludes the performance of radical surgical measures.

When a growth has burst through its tough serosal envelope it is easy to understand how malignant cells can be scattered locally and become implanted in the adjacent omenta, or how they can be swept farther afield and become grafted on to the peritoneal surface of the mesenteries or gravitate downwards to form plaques in the pelvic shelf.

The presence of enlarged nodes does not necessarily mean that these are invaded by cancer cells. With early ulcerative growths of the stomach it is common to find many enlarged regional lymphatic glands which are inflammatory rather than malignant in character. Enlarged lymph nodes do not of themselves prohibit resection, although when they are numerous and particularly when they are matted together they do render the dissection and mobilization of the stomach most difficult. If the growth is resectable but not all the palpable glands can with safety be removed, the surgeon should proceed with the operation and leave the inaccessible glands *in situ*. In all cases the nodes along the greater and lesser curvatures, those above, behind, and below the pylo-

ric segment of the stomach, and those crowded around the coeliac axis should be inspected and palpated, and their fixation posteriorly should be gauged. The omenta and mesentery are next scrutinized for seedlings. Multiple deposits of growth in the great omentum or in the peritoneum prohibit the performance of a radical operation. The finding of hard nodular masses or plaques in the recto-vesical pouch, knobbly implantation tumours on the surface of the ovaries, and minute pearly seedlings in the mesentery of the small intestine, all alike indicate the futility of proceeding further with the operation. The hand should be swept over the surface of the liver to palpate its surface, test its consistency, and examine it for the presence of any metastases. If the tumour in the stomach is resectable and there are only small implants in the liver, it is usually advisable to perform sub-total gastrectomy in order to offer the patient the maximum palliation possible.

Operative Procedures

It is proposed to discuss here only the treatment of those cases which have been deemed operable and in which after exploration it is found that the growth cannot be resected. In such circumstances the aim of any operation which is undertaken is to prevent the patient from starving to death, to prolong his life, meanwhile rendering him more comfortable as far as his digestion is concerned, to ward off or at least to postpone the advent of serious complications such as profuse haemorrhage, perforation, or severe toxæmia, and to ensure as far as possible that when death does occur it is the outcome of secondary implants in the

liver which produce but little pain rather than of obstruction with its tormenting agonies

Witzel's operation (see page 31) is the best procedure if an inoperable growth is found in the region of the cardia and this has produced obstruction. In cases of extensive non-resectable growths of the body of the stomach unassociated with obstructive symptoms no useful purpose will be served by performing any palliative operation. In such circumstances, after the surgeon has satisfied himself that nothing further can be done, the abdominal incision should be securely closed.

In cases of irremovable cancer of the pyloric segment of the stomach, although posterior—or preferably anterior—gastro-jejunostomy has been widely practised, some operation based on the principle of Devine's fulfils all requirements, for the following reasons:

1. The death-rate is not higher than that which follows gastro-jejunostomy; in fact, the operative death-rate of partial gastric exclusion combined with end to-side gastro-jejunostomy is lower than that of the simple short-circuiting operation.

2. The expectancy of life is prolonged. Where gastro-jejunostomy has been performed it has been shown that patients usually live for a month or two longer than when simple exploration alone is carried out, but by the procedure here described, i.e. Devine's operation, the length of the patient's life may be prolonged by several months.

3. The patient is prevented from dying of obstruction, as the gastro-enteric stoma is very large (the whole of the cut end of the stomach is utilized in fashioning the anastomosis) and is widely removed

from the primary growth which is excluded. Where, however, a gastro-jejunostomy is performed, the stoma is apt to become occluded by the growth which spreads into the body of the stomach from the pyloric region or becomes compressed by metastatic nodes in the mesocolon or great omentum.

In performing a gastro-jejunostomy there is also a tendency to place the opening too high up in the body of the stomach in order to ensure that the anastomosis is as far removed as possible from the involved portion of the stomach, thus resulting in a poorly functioning stoma which affords but little relief.

4. The immediate post-operative results, as I have shown (*Ann. Surg.* 104, 161, 1936), are eminently satisfactory. It is at once possible to administer fluid nourishment by mouth in unstinted quantities, appetite is restored, cachexia disappears, and the patient's general condition is greatly improved.

Partial Gastric Exclusion followed by End-to-Side Gastro-Jejunostomy by Devine's Technique

An excellent account of this operation is given by Devine (*Surg., Gynec. and Obst.* 40, 1, 1925), and the following description is based on his technique. I have introduced certain modifications in order to render the operation both simpler and quicker.

After the abdomen has been exposed by a vertical epigastric incision, the stomach is carefully inspected and palpated and the exact position of the growth, the amount of stomach involved, and the extent of extra-gastric spread and lymphatic involvement are ascertained. If after methodical exploration radical gastric resection is considered to be inadvis-

able, or impossible owing to the nature of the pyloric growth, but the remaining portion of the stomach is found to be healthy, the body of the stomach should be transected as high up as possible, the pyloric segment excluded, and the operation completed by performing an end to side gastro jejunostomy by the ante colic method

The first step in the operation is the ligation of the main branches of the right and left gastric arteries and the freeing of the gastro hepatic omentum from the lesser curvature of the stomach, after which the gastro colic omentum is widely ligated along the greater curvature so that the body of the stomach may be lifted up and its under surface inspected, any adhesions which may exist here being freed

The field of operation is packed off, after which a Friedrich Petz clamp is applied high up on the body of the stomach from the greater to the lesser curvature and as far as possible away from the growth in the pyloric segment (fig 48) The instrument is forced home, the stomach is crushed, and the two rows of fine metal clips are inserted with mechanical precision and neatness (fig 49) After removing the clamp, two pairs of Allis forceps are applied to the lesser curvature and two pairs to the greater curvature about 1 inch away from the crushed portion of stomach The stomach is then divided between the two rows of Petz clips This process is bloodless and there is no spilling of gastric contents (fig 50)

The pyloric stump is then picked up and steadied and the crushed end with its single row of clips is invaginated with a continuous Lembert suture of fine silk, the suture line being further reinforced with a

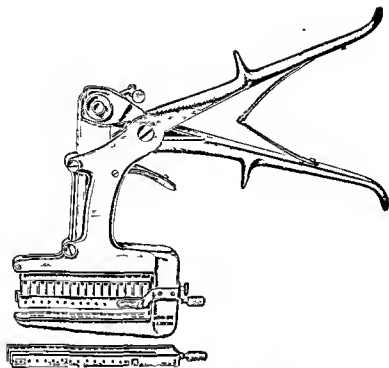


FIG. 48. Friedrich-Petz clamp.

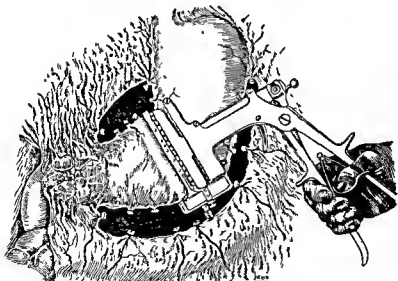


FIG. 49 Partial Gastric Exclusion for irremovable Cancer of the pyloric segment of the stomach.

The Friedrich-Petz clamp is applied to the body of the stomach and the two rows of metal clips are inserted by forcing the instrument home.

series of interrupted sutures, which in turn are deeply buried with a Cushing right-angled continuous stitch.

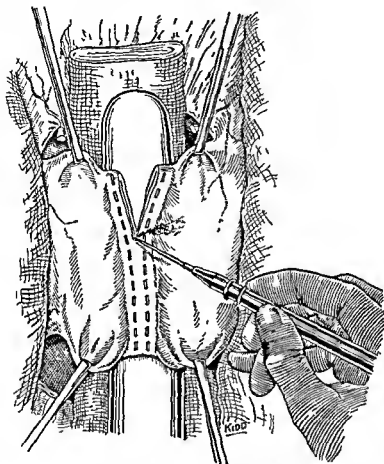


FIG. 50 Partial Gastric Exclusion for irremovable Cancer of the pyloric segment of the stomach

Transection of the body of the stomach between the two rows of metal clips by means of an electric cauterium.

Thus the pyloric pouch in which the growth is contained and excluded, when securely closed in this way, presents a smooth even surface, thereby preventing the subsequent formation of adhesions (fig. 51).

When this step is completed, the proximal jejunum is picked up, drawn over the transverse colon, and a

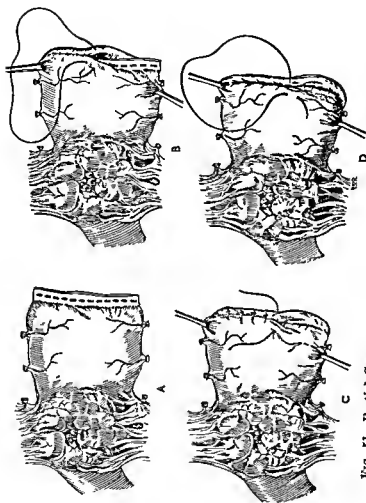


FIG. 51. Partial Gastric Exclusion for irremovable Cancer of the pyloric segment of the stomach.
Closure of the pyloric end of the stomach by means of a series of sutures.

segment of bowel some 12 inches from the duodeno-jejunal flexure is applied to the cut end of the stomach

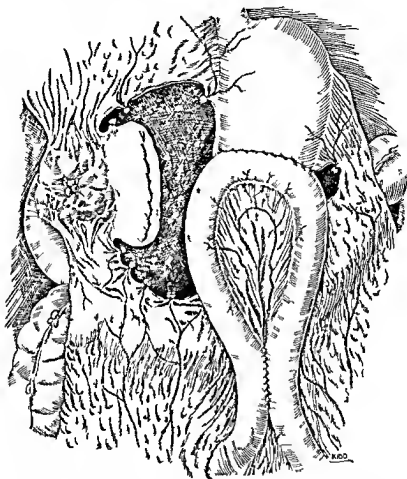


FIG 52 Partial Gastric Exclusion for irremovable Cancer of the pyloric segment of the stomach

Ante colic anastomosis combined with entero anastomosis as suggested by Balfour

from right to left and from the lesser to the greater curvature. The crushed groove with its contained clips at the end of the gastric segment is trimmed away with scissors, and the whole of the cut end of the stomach is anastomosed to the jejunum as in the

operation of gastro-jejunostomy (figs. 52 and 53). No enterostomy clamps are used in the making of this anastomosis.

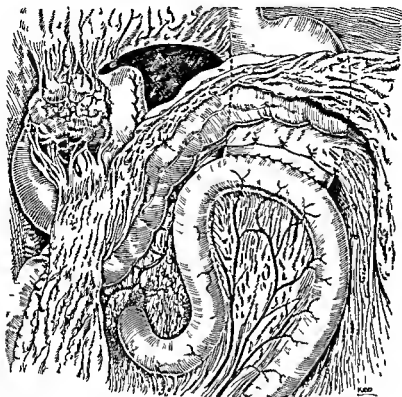


FIG 53 Partial Gastric Exclusion for irremovable Cancer of the pyloric segment of the stomach

A retro colic gastro-enteric anastomosis has been performed

The abdominal wound is closed with a series of sutures of floss silk or stainless steel alloy wire, and the skin edges are drawn together with interrupted sutures of fine silk.

Technique of Gastro-Jejunostomy for Irremovable Growths of the Pyloric Segment of the Stomach

If the surgeon elects to perform a gastro-jejunostomy instead of Devine's procedure, he is well

advised to adopt the anterior operation, as the stomach is usually adherent to its bed posteriorly and the mesocolon quickly becomes implicated by the spread of the malignant process.

The opening in the stomach should be made at the greater curvature or slightly above and parallel to it. No part of the gastro-enteric stoma should encroach upon the malignant zone of the stomach.

The immediate and late results of gastro-jejunostomy in the treatment of irremovable growths of the pyloric segment of the stomach have been so disappointing that I have abandoned this operation in favour of Devine's procedure.

CHAPTER XVIII

THE MANAGEMENT OF GASTRO-JEJUNAL ULCER

GASTRO JEJUNAL ulcer (syn secondary peptic ulcer, jejunal ulcer, stomal ulcer, anastomotic ulcer, and marginal ulcer) is one of the commonest and gravest of the complications which follow anastomosis of the stomach to the jejunum or to the duodenum

It is universally agreed that gastro jejunostomy for duodenal ulcer is the operation most frequently followed by anastomotic ulcer

When gastro jejunostomy is performed for the non obstructive types of duodenal ulcer associated with a high acidity, the incidence is approximately 15-20 per cent, but when this operation is carried out for pyloric obstruction caused by a cicatrizing duodenal ulcer and repeated test meal examinations reveal that the acid values of the gastric juice are markedly and permanently reduced, the incidence of subsequent jejunal ulceration is only about 1-2 per cent, and the late results from this simple short circuiting procedure are in every respect most gratifying

Gastro jejunal ulcer is rarely observed after gastro-jejunostomy or sub total gastrectomy for cancer of the stomach Judd reported one case, but Garnett Wright (*Brit Jl Surg* 22, 433, 1935) was unable to find a single case out of 436 which were traced, and he offers the following explanations for the absence of this complication

1. That these patients do not live long enough for gastro jejunal ulcers to appear, but this is only

true in part since gastro-jejunal ulcers may develop very quickly.

2. That symptoms of secondary ulcer are likely to be masked by those produced by cancer.
3. That in cancer of the stomach there is commonly an absence of hydrochloric acid in the gastric juice, or at least there is either a marked reduction in acid or a diminished peptic activity.

The incidence of gastro-jejunal ulcer after partial gastrectomy for gastric ulcer is about 1 per cent., while after gastro-jejunostomy it is certainly not higher than 3 per cent.

The commonest period of life at which these ulcers occur is between the ages of 35 and 45. Males are more susceptible than females, and the proportion is at least 4 to 1 for primary ulcer and approximately 13 to 1 for jejunal ulcer. In Lahey's series there were 90 males and 10 females. There are certain types of individuals—those with the hypersthenic gastric diathesis, as Hurst has stressed—in whom there seems to be a greater tendency to the development of gastro-jejunal ulceration following gastro-jejunostomy for peptic ulcers than in others. The younger the patient and the higher the acid values in the gastric juice, the more likely is the occurrence of gastro-jejunal ulcer. Conversely, elderly patients with hypochlorhydria or achlorhydria are almost immune to this complication provided the gastro-jejunostomy has been well executed.

There are certain types of operative procedures which, when carried out in the treatment of chronic duodenal ulcer, are well known to predispose to the formation of gastro-jejunal ulcer, and in particular I would cite :

1. von Eiselsberg's exclusion of the pylorus followed by end-to side or side-to-side gastro-jejuno-stomy.
- 2 Roux's anastomosis in Y
- 3 The Moynihan I operation (*Abdominal Operations*, 1, 299, 1926)
4. Gastro-jejuno-stomy combined with jejuno-jejuno-stomy; and
- 5 Partial gastrectomy combined with jejuno-jejuno-stomy.

It should be laid down as a definite rule that none of the above operations should ever under any circumstances be performed in the treatment of chronic duodenal ulcer, and that gastro-jejuno-stomy should not be employed in young or middle-aged patients, in those in whom there is a concomitant hyperchlorhydria, or in those cases in which chronic obstructive symptoms are absent.

Technical errors in the performance of the original operation may slightly increase the frequency of the lesion, but they are not by any means the primary cause. It has been thought that the use of silk sutures accounted for a number of cases, but there is no proof that the employment of an absorbable suture material is any safeguard against secondary ulceration, since the complication appears to be equally common after the use of silk and of catgut. It has been suggested that the crushing effect of enterostomy clamps used during the performance of the anastomosis may be responsible for trauma of the mucous membrane which, under the influence of the eroding gastric juice, may in turn initiate or perpetuate the process of ulceration. When employed with ordinary care and skill, however, clamps cannot be said to play an

important part in the production of this lesion, since gastro-jejunal ulceration occurs with equal frequency when clamps are not employed. Again, as Judd and Hoerner have pointed out, experimental work has repeatedly demonstrated that acute traumatic gastric and jejunal ulcers heal rapidly and show no tendency whatsoever to chronicity. Thus, we should expect these lesions to be healed by the time symptoms of gastro-jejunal ulceration usually appear, i.e. two years or so after operation.

Excision of the redundant gastric and jejunal mucosa before proceeding with the continuous haemostatic suture has been blamed by some for the occurrence of gastro-jejunal ulcer. It was naturally thought that certain raw surfaces which remained at the line of anastomosis, being unprotected by mucosa, came freely into contact with the gastric juice to which they were unaccustomed, with the consequent production of ulceration; but as ulceration appears to be equally common when the redundant mucosa is not excised, this cannot be accepted as an important factor.

Complications

The dangers of gastro-jejunal ulcer are: (1) perforation, (2) haemorrhage, and (3) gastro-jejuno-colic fistula.

Perforation calls for immediate operation and simple closure of the opening in the bowel. Some of the cases which perforate and which are treated on these lines subsequently do well on medical treatment. I have two patients who, following simple suture of a perforated jejunal ulcer, have remained in good health for periods exceeding 5 years.

Haemorrhage from a gastro jejunal ulcer should in the first instance be treated along conservative lines. Recurrent attacks of haemorrhage and severe bleeding which is difficult to control with blood transfusions and medical measures call for radical gastrectomy as soon as the patient's general condition will permit of the performance of this severe operation.

Gastro jejuno colic fistula demands operation immediately following a period of supportive treatment.

Treatment

It is still taught that all gastro jejunal ulcers are immediate surgical problems and that there is no medical treatment for this serious complication. This, of course, is not true. There is no doubt that a number of patients suffering from gastro jejunal ulcers recover completely and derive lasting benefit from well applied medical therapy. Their ulcers heal and remain permanently healed. I hold the view that it is sound treatment to submit any patient with a gastro jejunal ulcer to a trial of medical treatment just as with a patient who has a chronic duodenal ulcer, and provided the symptoms can be well controlled and occult blood disappears from the stools, this continuation of conservative treatment is wise and commendable. If, however, in spite of a well planned regime of treatment there is a persistent recurrence of dyspeptic symptoms, pain is intractable, occult blood continues to appear in the stools, and the patient is losing strength and courage, radical surgery should be invoked.

Surgical Treatment

There is no place for conservative surgical measures

in the treatment of gastro-jejunal ulcer. If surgery is demanded, it must in every instance be radical.

I consider that sub-total gastrectomy together with excision of the gastro-jejuno-stoma and of the ulcerated zone at or near the stoma or in the jejunum is the only sound method of treatment for these lesions. I have tried conservative surgical means for gastro-jejunal ulcers and have been disappointed with the late results. It is futile to undo the gastro-jejuno-stoma and to perform another gastro-jejuno-stoma; it is futile to undo the gastro-jejuno-stoma and to perform Judd's or Finney's pyloroplasty or Jaboulay's gastro-duodenostomy; and if the duodenum is scarred by disease, it is equally futile to undo the gastro-jejuno-stoma and to restore the gastro-intestinal tract to its original status.

The operation of *restitutio ad integrum* can only be countenanced when the stomach and duodenum are normal in every respect, there being no evidence of past or present ulceration; when, in fact, the gastro-jejuno-stoma has presumably been performed for the relief of symptoms since at the second operation there is no trace of any lesion, either in the stomach or in the duodenum.

Unpickling a gastro-jejuno-stoma and restoring the gastro-intestinal stream to its original course is unsound practice if the duodenum shows any signs of former trouble, i.e. puckering, fixation, narrowing, or fibrosis, as in most of these cases the original lesion once again becomes active and the surgeon then finds himself in the same position as he was before the gastro-jejuno-stoma was performed.

In order to ensure the maximum amount of muscular relaxation, the operation is carried out under

spinal anaesthesia, and this method has in my experience contributed largely to the safety and the smoothness of performance of radical gastrectomy for gastro jejunal ulceration

As most gastro jejunal ulcers are situated in the left lower part of the epigastrium or to the left of the umbilicus, and as a high gastric excision must be undertaken, the abdomen is best explored through a long left paramedian incision which starts precisely at the costal margin and finishes some 2-3 inches below the umbilical cicatrix

If the former operation was an anterior gastro-jejunostomy, the proximal and distal limbs of the jejunum should be crushed and divided between enterotomes, jejunal continuity should be established by the performance of an end to end jejuno jejunostomy, and after the gastro duodenal resection has been carried out, the proximal loop of jejunum should be anastomosed to the cut end of the gastric segment after the ante colic Hoffmeister Finsterer plan

If the original operation was a posterior gastro jejunostomy, the steps of the resection will be as follows

- 1 Transection of the afferent limb of jejunum between enterotomes proximal to the gastro enteric stoma

- 2 Transection of the efferent limb of the jejunum between enterotomes just distal to the gastro enteric stoma

- 3 Restoration of intestinal continuity by the performance of end to end jejuno jejunostomy

- 4 Closure of the ends of the excised jejunal segment

- 5 Separation of the colon from the gastro jejunostomy

stomy when a gastro-jejuno-colic fistula is present, and also when the colon is merely adherent by fibrous adhesions to the region of the stoma. If in the process of this separation the colon is found to be perforated, as it will be in cases of fistula, the opening should be closed immediately with a series of interrupted silk sutures, after which the invaginated portion of bowel is reinforced with a fatty pad of great omentum.

6. The mesocolon is dissected free from the gastro-jejunosomy or perhaps from an area of posterior wall of stomach proximal to the stoma, due care being taken during this manoeuvre not to injure the middle colic artery (fig. 54).

7. The rent in the mesocolon is cautiously closed with a running stitch.

8. The stomach and the first portion of the duodenum are freely mobilized by dividing their vascular attachments and by liberating the stomach from its adherent bed, much in the same way as in the standard Polya operation.

9. After the duodenum has been transected and the distal cut end of the bowel is securely invaginated, and after the stomach has been completely mobilized, the proximal jejunum is picked up and a portion of it some 10 inches or so from the duodeno-jejunal flexure is selected for anastomosis with the stomach. This segment of jejunum is drawn over the transverse colon and applied to the upper fifth of the under-surface of the stomach from left to right with its proximal point at the lesser curvature and with its distal point at the greater curvature.

10. The gastric resection must be high to ensure that an extensive area of the acid-secreting portion of the stomach is removed. In the average case about

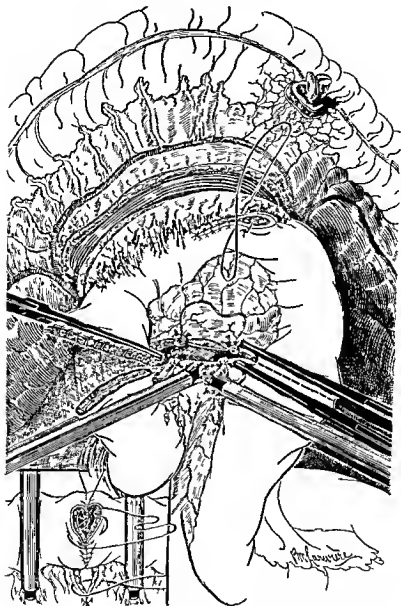


FIG 54 Radical Sub total Gastrectomy for Gastro jejuno colic
Fistula

four-fifths of the stomach and the major portion of the first part of the duodenum are resected. No clamps are used, not even the sewing machine of

Petz It is quite impossible to perform a really high gastric resection if enterostomy clamps are employed. If the Friedrich-Petz clamp is used to facilitate the transection of the stomach and to minimize soiling, it is most important to trim away the clips in the crushed gastric groove before completing the anastomosis, since the leaving of any *in situ* would predispose to the formation of a secondary ulcer.

11 The anastomosis is performed, as I have said, without the aid of any clamps or special appliances, the upper half of the cut end of the small gastric pouch is closed and inverted, the lower half is anastomosed to the jejunum, and the portion of small intestine immediately proximal to the stoma is buttressed against the newly constructed lesser curvature, as in the Hoffmeister-Finsterer operation.

When the operation is completed, the proximal limb of jejunum is not anastomosed to the distal limb of the jejunum, since if this were done all the alkaline juices coming from the duodenum would be shunted away from the gastro enteric stoma, thus predisposing to the formation of another marginal ulcer.

I prefer an ante colic rather than a retro colic anastomosis, since the former is distinctly easier to perform and is followed by fewer disagreeable post-operative symptoms. Furthermore, if perchance a secondary ulcer does develop at some subsequent date, it is very much easier to approach and to attack it than would be the case if it occurred after partial gastric excision with a stoma placed in the infra colic compartment.

The operative mortality of sub total gastrectomy for gastro jejunal ulceration varies from 5 to 15 per cent.

Post-Operative Care

Within a few hours of the operation the patient is allowed to drink water, barley water, and sweetened fruit juice. If there is no retention in the small gastric pouch, no ileus of the jejunal coils, no cramp like epigastric pains, and no vomiting, the patient is given fluids by the oral route *ad libitum*. As the anastomotic line will never be so strong and secure as it is during the first 3 or 4 days following operation, and as the liberal administration of fluids by mouth effectively washes out the gastric loculus, relieves thirst, augments peristalsis, diminishes the incidence of acute dilatation, promotes sweating and diuresis, and flushes the reservoirs of the body with much-needed water, salts, and sugars, this method has much to commend it and in practice has proved highly successful.

I have altogether abandoned the use of subcutaneous and rectal infusions. If for one reason or another the patient is unable to take fluids by mouth in the immediate post operative phase, blood and glucose saline solution are run into a vein by the slow drip method elaborated by Marriott and Kekwick. In the average case the patient is on light fluid nourishment in about 4-5 days, a non residue diet in about a week, and a generous nutritious fare by the time he is fit to leave hospital, i.e. on about the 17th day following operation. Post operative shock, or collapse owing to the loss of blood during gastric operations, is rarely seen nowadays, but when it does occur it should be promptly treated by blood transfusion, adequate doses of morphia or omnopon, and warmth.

A steady rise in the pulse rate accompanied by a

feeling of constriction in the epigastrium is noticed in a few cases about 24-48 hours after sub total gastrectomy. This is not usually a sign of internal haemorrhage or of a spreading peritonitis, but rather of the inaugural phase of an acute dilatation of the stomach and of ileus of the proximal coils of the small intestine. The treatment is simple and dramatically effective and consists in passing a Ryle tube or similar small stomach tube through the nostril or through the mouth into the gastric loculus and applying suction-siphonage for about 24 hours. On this treatment the pulse-rate at once starts to drop and is reduced from 130-120 to within the normal limits in a few hours. About 500 c.c. of blood and 2,000 to 3,000 c.c. of saline glucose are given intravenously concomitantly with the suction-siphonage. After partial gastrectomy the pulse-rate is a most efficient guide to the progress of the case. If there is no appreciable rise during the first 3 days after the operation, a rapid and uninterrupted convalescence may be confidently predicted. Furthermore, the subsequent progress of these cases is in every respect more satisfactory as regards digestion than it is with those who have had a stormy convalescence.

The secret of good technique in gastric surgery is meticulous care and gentleness during the conduct of the operation, the elimination of haemorrhage and of peritoneal soiling, accurate suturing which leaves nothing to chance, and the fashioning of gastro-enteric anastomoses which are mechanically perfect and free from any tension.

The secret of successful post operative management lies in the employment of suction-siphonage to forestall complications such as acute ileus, and the

combating of collapse by blood transfusion and of pulmonary atelectasis by suction-bronchoscopy. The prompt use of suction-bronchoscopy has almost entirely ruled out post operative pulmonary complications, which accounted for many deaths after subtotal gastrectomy for peptic ulceration. This point receives special emphasis from Lahey (*Surg. Clin N. Amer* 20, 767, 1940)

No purgatives, no enemata, and no injections of pituitrin and such like drugs are given until clamant peristaltic sounds heard through a stethoscope announce that the intestines are active once again and are in need of some stimulation.

CHAPTER XIX

INJURIES OF THE STOMACH

THE causes of injuries to the stomach may be classified as follows

- 1 *Violence from Without* (a) non penetrating wounds, e g severe blow on the epigastrium, (b) penetrating wounds, e g gunshot wounds, (c) operative trauma, e g injury to the stomach during the conduct of an operation such as splenectomy
- 2 *Violence from Within* (a) the passage of instruments, e g a gastroscope, (b) the ingestion of foreign bodies or of highly corrosive fluids, (c) spontaneous rupture of the stomach

The instances of rupture of the stomach due to violence from within are very rare nowadays, and the subject can be dismissed in a few words. Perforation of the oesophagus just above the cardiac orifice or of the walls of the stomach, a number of cases of which were recorded when the rigid gastroscope was employed, is now an almost unheard of accident and only occurs when some pathological condition has made the oesophagus unduly thin and friable or when the surgeon is lacking in an ordinary degree of skill and care. The special construction of the new flexible instrument, such as the *Wolff Schindler* gastroscope, prevents any damage being done to the oesophagus or the stomach during gastroscopy. Henning had no mishaps to report in examining over 1,400 cases, and similar experiences were recorded by Harold Edwards, Rogers, and Hermon Taylor.

The swallowing of highly corrosive fluids, such as

carbolic acid, may literally burn a hole through all the coats of the stomach, but here death rapidly supervenes from shock suffocation due to oedema of the larynx, fulminating pneumonia, or acute toxæmia, or, if the patient survives for a few days, from acute spreading peritonitis. This must, however, be an exceedingly rare cause of perforation of the stomach.

Certain foreign bodies may be swallowed and these may injure or even penetrate the coats of the stomach and produce a subphrenic or peri gastric abscess or general peritonitis.

Spontaneous rupture of an apparently healthy stomach is a rare and interesting condition and all the cases reported to date have proved fatal. Glassman (*Ann Surg* 89, 247, 1929) in his instructive paper recorded 14 cases which he was able to collect from the literature.

Rupture most frequently occurs in the region of the lesser curvature close to the cardia, as here the gastric wall is at its thinnest, the mishap being attributable to a spontaneous over distension which may be caused by some severe muscular effort or by a particularly fierce attack of vomiting.

Immediately rupture takes place the patient is seized with acute abdominal pain and all the clinical phenomena are indistinguishable from those of an acute perforated peptic ulcer with profound collapse, demanding urgent surgical measures.

Non-Penetrating Injuries of the Stomach

Non penetrating or subcutaneous wounds of the stomach are caused by sudden violence to the epigastrium such as a kick, blow, fall, buffer or run over

accident, motor car or aeroplane crash, and so forth, and are due to the stomach being crushed against the projecting and unyielding spinal column. In these cases although the belly wall may be contused there is no gross breach in its continuity. The nature and the extent of the damage done to the gastric wall show wide variations in individual cases. In some instances only one coat or possibly two may be torn—partial rupture, and the injury may pass undetected.

In bursting lesions, due to compression for instance, deep longitudinal fissures involving the seromuscular coats may be produced, and these usually lie along the line which is parallel to the greater or lesser curvature of the stomach. In other cases the stomach wall may be widely contused or be the site of a tense localized collection of blood. The danger of these mural haematomata is that they may become infected, and the abscess which results may cause a circumscribed patch of necrosis which on separating will leave a gaping hole through which gastric contents are free to pour into the general peritoneal cavity. In some cases the tear which involves the coats of the stomach is extensive, fissured or jagged, and the liver, spleen, upper coils of jejunum, ribs, &c, rarely escape injury.

Penetrating Wounds of the Stomach

Here the abdominal wall or the thoracic cage is perforated at one or more points by some sharp instrument such as a dagger, by a bullet, a piece of high explosive shell, &c, and the stomach itself is injured. In such cases concomitant trauma to near by viscera is a common occurrence, and it is well to

remember that the stomach may be perforated in more than one place

Gordon Taylor, in his book *The Abdominal Injuries of Warfare* (1940) gives a learned account of the management of these wounds

The stomach may be injured during the course of an abdominal operation, and such an accident is specially prone to occur during splenectomy when the upper portion of the gastro splenic omentum is being ligated and divided during excision of a cancerous mass in the transverse colon, or during secondary operations upon the biliary passages when the stomach and duodenum are so often inextricably welded to the gall bladder fossa

Treatment of Gastric Injuries

In the case of known or of suspected injury to the stomach exploratory laparotomy should be performed following a brief but intensive course of anti shock treatment. It is a mistake to persevere unduly long with pre operative treatment, and in the average case the patient should be subjected to operation within an hour or two of his admission to hospital. If the blood pressure is within normal limits, a spinal anaesthetic should be given, but if the blood pressure is low, and especially if it is rapidly falling a local anaesthetic is to be preferred. During the operation blood and glucose saline are run into a vein in the leg. Any surface wound or wounds which are present are freely excised and then carefully sutured, after which the abdominal exploration is conducted through an ample paramedian para umbilical incision which can be rapidly extended

upwards to the costal margin or downwards towards the pubis as the case demands.

Exposure must be good, and each organ must be examined methodically, since the stomach may, as already stated, be perforated in more than one place, and more than one viscus may be pierced, torn, or contused. If a wound is found on the anterior wall of the stomach, after it has been sutured the posterior surface of the organ should be examined through an opening made in the gastro-colic ligament. Small perforations should be closed by means of purse-string sutures, while complete linear tears should be stitched with three rows of sutures, the first uniting the edges of the mucosa, the second the seromuscular coats, and the third by introducing a Cushing right-angled stitch of fine silk which wholly invaginates the suture line.

Following suture of the stomach, colon, or small intestine in cases of injury, drainage of the damaged area or of the peritoneal cavity is not as a rule carried out, as this favours fistula formation and adhesions. When, however, general peritonitis is present, it is customary to drain for 24 hours, using a Penrose tube.

CHAPTER XX

THE TREATMENT OF HAEMORRHAGE AND OF VOMITING AFTER GASTRIC OPERATIONS

MANY complications may occur after gastric operations, and some of these have been considered previously, such as gastro-jejunal ulcer (see page 202), anaemia (see page 118), and pulmonary atelectasis (see page 214). Post-operative peritonitis is beyond the scope of this work, as are also certain chest complications such as pulmonary embolism, pneumonia, &c., and I propose to deal here with only two of these complications, namely haemorrhage and vomiting.

Haemorrhage after Gastric Operations

The causes of bleeding after operations upon the stomach or duodenum may be classified as follows:

1. *Immediate:* (a) from the suture line; (b) from the ulcer.
2. *Late:* (a) from the ulcer; (b) due to gastro-jejunal ulcer; (c) due to carcinoma of the stomach; (d) due to gastro-jejunitis; (e) due to acute retrograde jejuno-gastric intussusception.

Bleeding occurring immediately after gastric operations or during the period of convalescence is now a very rare complication. It is rare because gastrointestinal anastomoses are nowadays generally made without the aid of enterostomy clamps; the blood-vessels in the stomach wall, whether they be the entrant arteries or the emergent veins, are all individually underrun and ligatured; the suturing of the cut margins of the stomach to the cut end of the duodenum or gall-bladder or to the side of the jejunum is

carried out with three rows of continuous sutures, all of which are carefully inserted, and in the majority of cases the ulcer in the stomach or duodenum—or maybe in the jejunum—is widely excised.

If the ulcer in the stomach or duodenum cannot be resected, it should at least be treated with respect. It should never be roughly or repeatedly handled lest a troublesome hæmorrhage be initiated from the margins or from the base of the ulcer.

Clamps are being used less and less every day. They have, in my opinion, often marred the technical beauty and even complicated the performance of gastric operations. It is certainly true to state that it is quite impossible to carry out a high gastric resection when they are employed, and gastro-jejunostomy is always a better, safer, and tidier operation when clamps are discarded altogether.

If the surgeon has a penchant for clamps, he should apply them himself rather than relegate this important step to an assistant, he should apply them gently and compassionately to the friable and sensitive stomach and intestine, and furthermore he should apply them in such a way that the parts engaged in the anastomosis can be brought side to side without the slightest degree of tension.

It is claimed that the use of clamps helps to prevent peritoneal soiling and facilitates the introduction of sutures. This is especially true of the Billroth I types of repair, and more particularly of the Schoemaker and Finochietto operations. When no clamps are employed, soiling is eliminated by the constant use of the suction tube, and bleeding is controlled by the painstaking isolation, ligation, and division of the numerous vessels which are involved.

Should the patient therefore after a gastric operation vomit bright blood in any quantity, or should he become blanched, a serious view of the case must be promptly taken

Immediate Measures

If the patient continues to bleed

- 1 Haemoglobin and blood volume estimations are carried out at frequent intervals in order to check the progress of the case
- 2 The pulse rate is recorded every 15 minutes, and the blood pressure every 30 minutes
- 3 The foot of the bed is raised on blocks
4. An injection of morphia, $\frac{1}{6}$ gr , is given, and this is repeated as required
- 5 The stomach is washed out through a large stomach tube with warm saline solution
- 6 No fluid nourishment is permitted by mouth
- 7 Blood transfusions are given
- 8 Calcium gluconate solution, 10 c c , is injected intravenously 8 hourly
- 9 Vitamin K is prescribed

Operative Treatment

If in spite of the above measures the pulse rate steadily increases, the patient continues to vomit bright blood, and the pathologist reports that it is obvious from his investigations that the blood transfusions and other measures employed are not controlling the haemorrhage, the abdomen must be explored and a search made for the bleeding point

The original abdominal incision is freely opened up, and waterproof sheets are affixed to the margins of

the wound and to the edges of the peritoneum to prevent any contamination of the wound.

The Previous Operation has been a Posterior Gastro-Jejunostomy

Here the surgeon has a choice of two procedures:

Method I. The anterior wall of the stomach opposite the stoma is incised longitudinally midway between the lesser and the greater curvatures for a distance of 3 inches, and the edges of the wound are held apart with stay sutures to permit of a ready inspection of the interior of the stomach and of the line of anastomosis itself. The gastric contents are aspirated, a tractor suture is inserted at each end of the anastomosis, and the gastro-jejuno-stomy is drawn through the anterior wound in the stomach wall so that it can be inspected. Any point or points on the suture line which are seen to be bleeding are now underrun and tied off with catgut, and the parts are sponged with warm saline solution to make sure that there is no oozing elsewhere along the suture line. If the oozing appears to be diffuse, i.e. coming from many points along the suture line, it is safer to oversee the entire circumference of the gastro-jejuno-stomy with a continuous lockstitch or with a haemostatic all-coats suture of No. 0 20-day chromic catgut. Should bleeding still persist at any one point it must be controlled by the insertion of a number of interrupted cross-sutures. The tractor sutures are then removed, and the anastomosis is allowed to drop back, after which the anterior wound in the stomach is closed with three rows of continuous sutures.

Drainage is not provided, and the margins of the

abdominal wound are approximated with a series of through and-through interrupted sutures of stainless steel alloy wire

Method II The posterior gastro jejunostomy is displayed by drawing the transverse colon and great omentum through the wound and by retracting these structures firmly in an upward direction, i.e. over the lower chest wall. The stitches which anchor the stomach to the opening in the mesocolon are individually picked up, snipped through with scissors, and removed. A further portion of the posterior wall of the stomach is now drawn fully through the wound in the mesocolon so that the gastro jejunostomy can be delivered on to the surface of the abdominal wall.

The anterior row of sutures in the anastomosis is divided and withdrawn, the margins of the wound in the stomach and jejunum are retracted, the gastric contents are aspirated, the area is mopped dry, and the posterior suture line is critically scrutinized. A new continuous through and through all coats suture of No. 0/20 day chromic catgut is passed, starting at one end of the posterior suture line and proceeding to the opposite end. It then continues anteriorly, uniting the cut margins of the stomach and jejunum firmly and evenly together in such a way that the risk of further bleeding is avoided.

The suture line is further reinforced and invaginated by a continuous Lembert stitch and then by a series of interrupted sutures of fine silk, after which the margins of the opening in the mesocolon are tacked round the gastric wall about 1 inch proximal to the gastro jejunostomy.

If in the previous operation the ulcer was not dealt

th, and if after the inspection of the posterior row of sutures it is obvious that the haemorrhage is not coming from the suture line, the ulcer must now either be excised or it must be freely exposed through an opening made in the anterior wall of the stomach or duodenum, and then efficiently obliterated with a number of deeply placed cross sutures of strong silk. The anterior incision is then closed in the usual manner and further reinforced with fatty omentum.

The Previous Operation has been an Anterior Gastro-Jejunostomy

Here again the anterior row of sutures is removed, the margins of the stomach and jejunum are drawn apart, the gastric contents are removed by suction, and the posterior row of sutures is inspected. A new through and through haemostatic stitch should now be introduced embracing all the coats of the stomach and jejunum, after which the anterior suture line is further reinforced with a Cushing right angled stitch.

The Previous Operation has been a Gastro-Duodenostomy

As in the previous operation, the anterior row of sutures is unpicked, any obvious bleeding point is under-run and ligated, and the posterior layer is further reinforced. From this point onwards the steps of the operation are identical with those of an ordinary *gastro duodenostomy*.

The Previous Operation has been a Partial Gastrectomy

I have never yet witnessed this complication after the Polya or Hoffmeister types of partial gastrectomy, nor has it occurred in any of my cases following the

Billroth I types of repair Secondary operation for control of haemorrhage following partial gastrectomy is undoubtedly a hazardous undertaking and cannot as a rule be recommended It would be wiser in such circumstances to place reliance on continuous-drip blood transfusion which so often proves successful If operation is enforced, the technical steps are in many respects similar to those already described

Vomiting after Gastric Operations

Vomiting occurring within a few hours or days of gastric operations—*early vomiting*—may be due to

- 1 Shock
- 2 Anaesthetic sickness, acidosis, &c
- 3 Acute dilatation of the stomach
- 4 Paralytic ileus
- 5 Acute spreading peritonitis
- 6 Nervous causes
- 7 Acute gastro jejunitis
- 8 Obstruction due to mechanical causes

The *late* causes of vomiting following gastric operations are

- 1 The formation of a new peptic ulcer or the reactivation of an old peptic ulcer in the stomach or duodenum
- 2 Gastro jejunal ulceration
- 3 The onset of malignant disease of the stomach
- 4 Peri gastric or peri duodenal adhesions
- 5 Chronic gastro jejunitis
- 6 Obstruction due to mechanical causes, e.g. contraction of the opening in the mesocolon following posterior gastro jejunostomy, retrograde jejuno gastric intussusception, and adhesions and bands.

Medical Treatment of Early Vomiting

Shock is combated by injections of morphia, by the application of heat to the abdomen, and by plasma transfusions, post-anaesthetic sickness by gastric lavage and intravenous infusions of glucose-saline; acidosis by the exhibition of alkalis and sugars; nervous vomiting by the administration of sedative drugs *per rectum*; and acute gastro-jejunitis by the giving of a weak hydrochloric acid mixture by mouth 6-hourly for 3 or 4 days.

The treatment of acute dilatation of the stomach and of paralytic ileus is identical

1. Morphia, $\frac{1}{8}$ gr, injected subcutaneously thrice daily.
2. Continuous suction-siphonage applied to an indwelling duodenal tube
3. Intravenous glucose-saline given by the slow-drip method and approximately 2,000 to 3,000 c.c. in each 24 hours
4. The application of heat to the abdomen and liver region
5. No fluids by mouth and no enemata are given; no purgatives are prescribed, and no drugs which stimulate the intestine to peristaltic activity are injected until flatus is passed normally.
6. The administration of 100 per cent. oxygen by the oro-nasal or nasal B L B mask, for as long a time as may seem indicated in the particular case, has proved invaluable, as has been stressed recently by Boothby, Mayo, and Lovelace (*Surg. Clin N. Amer*, 20, 1107, 1940).

Acute spreading peritonitis occurring after clean gastric operations such as a posterior gastro-jejuno-

stomy or a partial gastrectomy for simple ulcer is a tragedy, and is due in most instances to inept or overzealous methods of suturing. The treatment consists in reopening the abdomen at once, finding the rupture and securely closing it, removing the contaminated peritoneal fluids by suction and by drawing together the margins of the incision by the most expeditious method.

Secondary Operative Measures

Fortunately these are rarely called for, as the mechanics of gastric operations are now so well understood, and the majority of the acute obstructions occurring in the early post operative phase respond rapidly and satisfactorily to suction siphonage and restorative measures.

Secondary operative measures, however, are clearly indicated when the obstructive phenomena are obviously due to mechanical causes which defy all non surgical attempts at their correction.

1 *Obstruction following the Billroth I Types of Repair* Where obstruction follows any of the Billroth I types of operation, the secondary procedure advised is gastro jejunostomy. The surgeon should, however, never be in any haste to perform a secondary operation following a Billroth I repair, as gastric retention, bouts of vomiting, fairly rapid pulse rate, and general disturbance are almost invariable for the first few post operative days. Most of the obstructive phenomena are due to oedema of the stoma, and when this subsides and gastric function is restored, subsequent progress is usually uninterrupted, smooth, and in every respect gratifying.

2 *Obstruction following Pyloroplasty and Gastro*

Duodenostomy If the primary operation has been a Horsley or Judd pyloroplasty, or a Finney or Jaboulay gastro duodenostomy, the second operation for relief of the obstruction should be a gastro jejunostomy.

3 *Obstruction after the Polya Types of Partial Gastrectomy* Here obstruction very rarely occurs, when it does it may be due to one of the following factors

(a) Retraction of a gastro colic anastomosis into the supra colic compartment following a posterior Polya type of operation, the afferent and efferent limbs of the jejunum being compressed by the margins of the opening in the mesocolon

(b) Adhesions and kinking of the proximal jejunum which may have become adherent to the under-surface of the abdominal incision

(c) The employment of too short or too long a jejunal loop, if the former, angulation may result or the taut gut may become compressed even further by the distended transverse colon, if the latter, the vomiting may be due to waterlogging of the afferent limb of the jejunum

Obstructive symptoms are much more frequently seen when too short a jejunal loop has been used, as, after the operation, the small gastric loculus retracts upwards more than might be expected, dragging the already tight loop with it, and further flattening out the jejunum and kinking it at its fixed point at the duodeno jejunal flexure

(d) Obstruction of the jejunum proximal to the anastomosis This may occur after the excision of a large callous jejunal ulcer, and is due in some instances to the turning in of too much bowel wall into the lumen of the jejunum while repairing an extensive

defect following gastric resection for a jejunal ulcer. This complication, however, would never arise if the segment of jejunum engaged in the anastomosis were resected and gastro intestinal continuity restored by performance of end to end jejuno jejunostomy, or if, after cutting the jejunum free from the stomach, the opening in the intestinal wall were sutured after Finney's method (Devine, *The Surgery of the Alimentary Tract*, pp 574-6, 1940)

(e) Obstruction may result at the gastro enteric stoma through too much of the anterior margin of the cut end of the stomach being invaginated, thus leading to the formation of a wide valve

If after a trial with suction siphonage and the administration of intravenous glucose saline solution to replace fluids lost, it is apparent that a mechanical obstruction exists, the abdomen should be reopened through the original incision, the wound edges well retracted, and the duodenum and the parts engaged in the anastomosis very carefully brought into view. If either the afferent or the efferent limb of the jejunum is adherent to some neighbouring structure or to the parietes, or it has become kinked, it should be gently separated with the finger and prevented from contracting adhesions by wrapping a portion of the adjacent omentum around the affected segment of intestine. If kinking has occurred as the result of marked upward retraction of the small gastric pouch which remains after a posterior Polya gastrectomy, the sutures which anchor the stomach wall to the opening in the mesocolon should be snipped through with scissors, and the margins of the mesocolon then closed snugly around the proximal and distal limbs of the jejunum, thereby leaving the gastric loculus

and the anastomosis high up in the supra coele compartment

If the obstruction appears to be due to oedema of the stoma or to the formation of a gastric valve, the anaesthetist should be instructed to pass a small stomach tube through the nostril or mouth into the gastric pouch, the surgeon then guiding the tip of the tube through the stoma and then on into the distal limb of the jejunum. Nothing further needs to be done in these cases, and feeding is carried out through the indwelling tube until gastric function is restored.

If in the previous operation the surgeon has left too long a proximal jejunal limb and this has become waterlogged, the only feasible method of overcoming the obstruction is to perform a side to side jejuno-jejunostomy. The stoma, however, should be made very small, just large enough to admit the tip of the finger, to ensure that only a portion of the alkaline juice is deflected from the region of the gastro enteric stoma. If, on the other hand, the proximal limb of the jejunum is too short and appears to be taut, the surgeon should again guide the stomach tube into the distal coils of jejunum for feeding purposes, and hope that with subsequent stretching efficiency of function will be established.

Vomiting after Anterior Gastro-Jejunostomy

If the primary operation has been an anterior gastro jejunostomy and this is followed by regurgitant vomiting due to the anastomosis becoming adherent to the under surface of the abdominal wound, to the afferent portion of the long loop of jejunum becoming waterlogged, or to the loop being compressed by the transverse colon, the secondary

operation for relief of the condition should be the fashioning of a small entero anastomosis between the efferent and afferent limbs of jejunum. It is highly important to make the jejuno jejunostomy as close to the duodeno jejunal flexure as possible.

Vomiting after Posterior Gastro-Jejunostomy

Intractable vomiting after posterior gastro-jejunostomy may be due to one of many causes, but the following are probably the commonest

1. The use of too long or too short a proximal limb of jejunum
2. The making of too small an opening in the mesocolon, suturing it to the jejunum, or leaving wide gaps in the mesocolon when it has been sutured to the stomach wall proximal to the gastro enteric stoma
3. Making the anastomosis at an unsuitable site, e.g. high up in the posterior wall of the stomach
4. Making the opening in the stomach too small
5. Atony of the stomach

If the regurgitant vomiting is due

(a) To the use of too long an afferent loop, this may be overcome by the performance of a side to side jejuno jejunostomy, but the possibilities of the subsequent formation of a gastro jejunal ulcer are considerable

(b) To the anastomosis being too small, improperly placed, or to the proximal limb being too short, it is often wiser to undo the gastro jejunostomy, close the openings in the stomach and in the jejunum, and perform another gastro jejunostomy

(c) To oedema of the stoma when the mechanics of the operation appear to be satisfactory, no secondary

operative procedure should be carried out. Here a Ryle tube should be passed through the nostril or mouth, led into the stomach, threaded through the stoma and on into the distal limb of the jejunum. Feeding is carried out through the indwelling jejunal tube until gastric function is once again restored to normal.

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